

START

TM

Spring 1987

Volume 1, Number 4



FEATURES:

Customize Your Desktop
The START Icon Editor

Tom Hudson Double-beader
Printer Drivers
The Easy Way

Ray-Tracing
Construction Set

START Chart
ST Databases Explored

Tom Jeffries Shows You
The Ins, Outs and
Thrus of MIDI

Fantastic Color From
Your Black and White
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Personal Pascal
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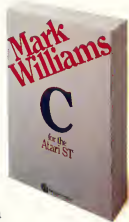
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STARTTM



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START welcomes submissions. Please include both hard copy printouts of articles and program listings as well as disk files on ST compatible disks. Media will be returned if self-addressed, stamped mailer is supplied. START assumes no responsibility for unsolicited editorial materials.

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WANTS DATABASE INFO

Recently I became the proud owner of an Atari 520 ST computer and I'm now yearning for a good database program to aid in organizing and indexing my collections of books, albums, videocassettes and software. However, I'm somewhat confused about the basic features of commercial database programs. For example, will these programs allow me the flexibility of accessing information in a variety of ways, such as alphabetically, categorically, by date, price, etc.? Also, what does the word "relational" mean when used in describing databases?

Deneyse White

Morroby, CA

Please see our "Database Overview" by Brian Lee in this issue of START. It should answer some of your questions, or at least point you in the right direction of some good ST databases. Also, check the reviews and New Products section of The ST Resource in each month of Antic magazine for additional software information.

WANTS AUTO PROGRAMS

The ClipBoard section of START contained a note about placing .PRG files in an AUTO folder so they will autoloading. I placed 1ST Word in such a folder with no luck. Am I doing this wrong, or is there a special trick I need to know?

Dan Proctor

Banning, Calif.

There are two basic types of .PRG files as far as the AUTO folder is concerned: Those which make calls to GEM and those which don't. When the ST boots up, one of the first things it does is check for an AUTO folder. Unfortunately, the ST has not initialized GEM when the AUTO folder is searched, so any program in the AUTO folder which makes calls to GEM will crash. Programs which make no calls to GEM will operate

properly. Don't give up, however, as START has programmers working on this problem at this very minute. Stay tuned!

NEW ST KEYBOARD?

Help! Those fat keys on the ST have got to go! I do a lot of writing on my ST, and wind up spending time thinking of ways to replace the keys. Does anyone know of a computer with IBM-like keys which will fit onto an ST keyboard?

Tom Gladan

Lincolnwood, Ill.

Atari designed the ST keyboard layout to resemble the DEC VT-100 terminal. As Leonard and Sam Tramiel have said, keyboard feel is extremely subjective—some people love soft keyboards, others enjoy those with tactile feedback. There are reports, at press time, that Atari has a new ST configuration with a separate keyboard, resembling a standard IBM-type PC. However, we are not aware of any replacement keytops which will fit on the ST. Anyone out there have information on this?

ULTIMATE PAINT PROGRAM?

I have been holding out buying a paint program. From the very beginning I have been fascinated with NEOchrome that came with my ST. I have seen PaintWorks and DEGAS in action—but not DEGAS Elite—and I am afraid to buy one of these programs because of the impending final version of NEOchrome. Whatever happened to it? Is it still a possibility or can I go on and buy one of the other programs without seeing a bigger, better version of NEOchrome on the shelf a week later?

Gerd Knaak

Houston, Texas

START never recommends someone wait for the next level of technology, which is always advertised as being available "Real Soon Now." DEGAS Elite and PaintWorks are

DIALOG BOX

available now right off the shelf. At press time, ATARI reported a final version of NEOchrome being readied for release, to retail for \$49.95. Some of the more fascinating aspects of it are dynamic picture stretching and cut and paste.

CALLING DAVE & SANDY. . .

I want MacCartridge! I want MacCartridge! I want MacCartridge! Please ask David Small how we go about getting one.

Bruce Daniell
Niceville, Fla.

The cart is now known as the Magic Sac, and is advertised as an upgrade to your Macintosh computer. Bruce, plan on making two purchases. First, get the cartridge from Data Pacific, 609 East Speer Blvd., Denver, CO, 80203. Phone (303) 733-8158. List price is \$129. Second, contact B & C Computervision at 3283 Kifer Road, Santa Clara, CA 95051. Phone (408) 749-1003. B & C Computervision will sell you 64K MAC ROMS, which you can then insert into the Magic Sac.

POWER WITH A LOWER PRICE

After spending over \$2000.00 on my 1040 ST system, I cannot justify the purchase of either MegaMax C or the Atari Developers Kit, as they both approach 10% of my hardware investment. Because of favorable reviews in your magazine and others, I purchased Personal Pascal from OSS. From its low price and apparent popularity, I counted on at least one Personal Pascal article per issue in the available ST magazines. However, it seems a majority, if not all, of your programs are written in C. Could you provide some guidelines for translating C source code into Pascal?

Frank Reyes
Ventura, Calif. ▶

IT'S ABOUT TIME

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CIRCLE 051 ON READER SERVICE CARD

WHERE'S MY DISK?



START is a magazine with programs on disk. Normally you will find the disk bound into the magazine and selling on the newstands for \$14.95.

But some of you ST enthusiasts want to read START first, so we have provided a limited number of copies without disk for \$4.00 each.

If this is your situation you can complete your copy of this issue of START by ordering the companion disk direct from us, for \$10.95 plus \$2.00 shipping and handling. See the order form inserted into this issue.

DIALOG BOX

The Atari Developers Kit and MegaMax C are professional software packages allowing the programmer to exploit the full power of the ST computer. Yes, Personal Pascal is low-priced, and many people have it, but currently, C submissions to both *START* and *Antic*'s ST Resource far outnumber submissions written in Personal Pascal. Regardless, we will endeavor to cover, to some extent, every language available for the ST, from BASIC to Pascal to Lisp.

Remember, this is *your* magazine. If you want to see an article about Personal Pascal in print, send us your ideas or finished articles. For the conversion from C into Pascal, examine some of the C listings in *Antic* Magazine: while there won't be a direct

translation, some of their C programs use the power of the C preprocessor to "Pascalize" the listings. Check them out—you'll see what we mean.

WORD IMPERFECT?

There seem to be a number of incorrect entries in the word processor comparison chart (*START*, issue 2, Fall 1986). For example, Mr. Chadwick didn't report that Regent Word supports microdot justification, and shows bold, elongated, super, and subscripted text during print preview. Or, for that matter, did he discover that Regent Word does, indeed, vary headers and footers, encompass variable line spacing in half-line incre-

ments, save custom print formats, include multiple fonts, search/replace non-ASCII text, print the disk directory, and include proportional print support, in addition to many other features.

Frank Cohen

REGENT SOFTWARE

I take exception to some of the items in *START*'s word processor review. First, the chart shows 1ST Word doesn't merge files, but you may "READ" a file into your current document anytime, starting where the cursor is. Next, you point out that 1ST Word doesn't have a command to move the cursor to the beginning or end of a line. Why would ▶

ALERT BOX

START #1: STEALING THE ST PRINTER DRIVER (p. 20)

Tom Hudson sent us an Email recently in response to readers' complaints that the JX80 printer driver source code on *START* #1 would not run correctly. Tom says,

Well, I finally sat down and looked at the JX80 source . . . It turns out that when I rearranged the equates, I mistakenly allowed only two bytes for the MASK variable, which is a LONG. Sheesh. So, the only change which needs to be made is:

```
YCOUNT equ 92  
At the top of the file.
```

START #1: SOPHISTICATED TEXT HANDLING (p. 52)

Corey Cole, another *START* author, found a problem with his TEX-

TDEMO program in *START* #1. The fix applies only to users of Megamax C. Megamax users need to modify the `malloc` statement, casting the argument to an `unsigned int`. As it appeared on the *START* Disk, it was defined as a `long int`, which is correct for Alcyon, but will crash with Megamax. To do the cast, simply insert `(unsigned int)` immediately inside the first parenthesis of the `malloc()` statement.

START #2: CLIPBOARD (p. 75)

Douglas J. Mathis, a system analyst from North Kingstown, Rhode Island, alerted us to the inefficiencies of the Clipboard trick which allows a program to ask, "Where am I?" He notes that the JSR plus MOVE solution takes 32 machine cycles, whereas the more elegant solution

```
LEA 2(PC),A0  
provides the same results in only 8 cy-
```

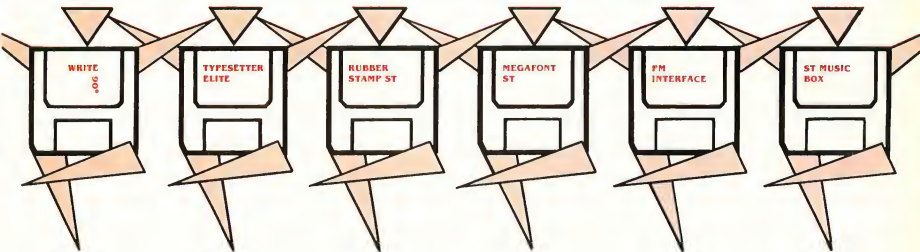
cles, according to his calculations.

Steve McIntosh of Long Beach, California, did a more ambitious dissection of the trick: he actually tried it with the AS68 assembler in the Developer's Kit. He found that AS68 had its own ideas about how

JSR LABEL

```
LABEL: MOVE.L (SP)+,A0  
ought to be interpreted. It quietly changed the JSR to a BSR, but continued to list it as a JSR in the output. This actually makes a lot of sense: for most intents and purposes, a BSR would be preferred over a JSR. But, when the assembler swaps the JSR with a BSR, it winds up with a branch offset of zero! This gives the assembler tummy trouble, so it then changes the BSR to a NOP without even a hiccup, let alone an error message. When you execute the code, not only do you not find out where you are, but it messes up the stack, resulting in almost certain doom. Thanks Steve. ■
```


The Atari ST Software Line Up



WRITE 90*

\$29.95 This package turns spreadsheets, text and screen output on their ear by allowing vertical formatted files to be printed sideways using continuous or single sheet paper. Incredibly useful for those over sized spreadsheets or flow chart style programs. Five character sizes are available. WRITE 90 is GEM based and supports Epson FX, SMM804, NEC, PROWRITER and compatible printers.

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—Darren Franchow, Consultant

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CIRCLE 052 ON READER SERVICE CARD

DIALOG BOX

you need one when you may move the mouse cursor anywhere onscreen, click, and the cursor moves there? Does your WP have a "move three lines down and thirty characters over" command? You say it doesn't show page numbers? What are those numbers in the left hand scroll column? How can you claim 1ST Word won't allow configuring the printer driver when the 1st Word disk has a PRINTER folder full of configuration files and an INSTALL program?

Kenneth Butcher
Oakland, Calif.

START stands corrected.

NEED DEVELOPERS KIT?

I cannot develop the programs from the compressed files on the START disk. I have tried many times to follow the instructions without success. Is it necessary to have Atari Developers Kit to produce the programs?

Harry Gensler
Novi, MI.

Most runnable files start with ".PRG", ".TOS", or ".TTP". You may click on these and run them instantly. As far as the decompressor goes, it will only unsqueeze a file with a "Q" as the second letter of the extender. You don't need to unsqueeze a file which does not have this "Q". Unsquencing a file does not compile it! Compiling a file requires a "compiler", understandably enough, so you should read "Which C For Me?" in START #2 (Fall 1986).

SOGGY START?

I just couldn't remain silent when I read your editorial and the reprinted letters in the front pages of START magazine's second issue. I understand the sentiments expressed by the readers who feel bewildered by the technical material in START about the ST. I sympathize, but please, don't water down the the pages of

START! I don't want hand-holding tutorials on how to open a file from the desktop, and I have no interest in reading a review of the latest, greatest game. I do want to see source code for things like Fujiboinkl, which nicely illustrate doing something fundamentally simple, but not-so-simple to figure out how to do on the ST. I do want useful utilities, like MouseTrap, and Tom Hudson's article on the EA IFF format. Basically, I just want to know what makes the ST tick.

Steve Rehrauer
Sutton, Mass.

Steve was also one of the winners of Atnic's DEGAS Art Contest. Thanks for the suggestions, Steve.

WANTS MONOCHROME LISTINGS

When you publish a review for a product in START, could you please tell us if it runs on a monochrome ST system? Also, please include at least one program in every issue which runs in monochrome.

John Hodges
Blacksburg, VA

START asks our contributors to attempt to make their listings runnable on either a color or monochrome system, but sometimes that isn't so easy. While it is possible, the program must be designed from the ground up as being either color or monochrome adaptable. The process for "colorizing" a monochrome program, or "monochromizing" (sorry, Mr. Webster), a color program is at best fantastically hard. Also, remember not everyone has both the color and monochrome monitor, so they aren't able to check out the program on the other system. We do agree with you that manufacturers should state which system their software runs on—color, monochrome, or both.

Darrel Anderson, professional artist, was introduced to his first computer, an Atari 800, two years ago to produce screen art for an interactive fiction game. Shortly afterwards, Darrel bought a 520 ST and applied its graphics capabilities to various projects, including the package illustration for an upcoming interactive fiction adaptation of Ray Bradbury's *The Martian Chronicles* (Bantam, NY). Using DEGAS, he designed 33 illustrations for *Best of the New Wave*, a science fiction anthology from Bluejay Books (NY). In another project, Ray Bradbury's *Fever Dream*, (Armadillo/St. Martin's Press, NY), he used a CAD 3-D model as a reference. Darrel was also the winner of the Antic DEGAS art contest. (See *Antic*, July 1986 for his winning entry.) He is also the author of the Future Design disk, a collection of CAD 3-D parts enabling you to build futuristic robots, spaceships, tanks and other science fiction vehicles. The Future Design disk is available from *The Catalog*.

Christopher Chabris, one of our ST language experts, has appeared in every issue of START and became a Contributing Editor as of last issue. A student of computer science at Harvard University, he is completing a book on artificial intelligence which will be published this year by Dow Jones-Irwin/Multi-science Press. Christopher is among the top 50 chess players in the United States under 21 years of age, and has won a National Master's rating.

Dale Giarratana, author of MacroPix, is currently a junior at Brick Memorial High School in Brick,

New Jersey. Between the ages of 9 and 14 he engaged in the sport of Moto-Cross Racing, and at 15 acquired a yellow belt in Judo. Presently he is an instructor of BMX (bicycle moto-cross) at the Shore Area YMCA. Dale got involved in computers through a computer course in school, and improved his skills by working on the 8-bit Atari computers. Dale is familiar with Logo, BASIC, Action!, Fortran, and Pascal. MacroPix is his first published program.

Contributing Editor **Tom Hudson** is the author of DEGAS, DEGAS Elite, and CAD 3-D, versions 1.0 and 2.0. He was head of programming with ANALOG Computing from 1982 to late 1985 before leaving to become a free-lance software developer. Tom has written two previous articles for START—"Stealing the ST Printer Driver" and "Swapping Art With Other Computers" in issues 1 and 2 respectively.

Tom's first computer was an IBM 1620 that he played with in high school. He worked his way through college teaching computer neophytes, then landed a job as programmer/operator at a savings and loan while earning his BS in data processing. Tom lives in Mission, Kansas and is a SYSOP in the 16-bit section of CompuServe.

Tom Jeffries has been a professional musician for more than 15 years. He has played first trumpet with the St. Paul Chamber Orchestra and the San Jose Symphony. He has also recorded with Dave Brubeck and on numerous TV and radio shows.

Tom currently heads a company

called Singing Electrons that develops and translates soundtracks and music-related software for microcomputers. He has written programs for the Atari ST, the Atari 8-bit computers, the Amiga, the Apple II, the Commodore 64, the IBM PC, and the Radio Shack Color Computer.

In addition to the ST version of MIDI Magic, Tom is doing development work for Dr. T's Music Software on the ST and has written or collaborated on CZ Patch, a patch editor for the Casio CZ-101, CZ-1000, CZ-3000, and synthesizers; Dr. T's KCS, a professional sequencer; and Dr. T's MIDI Studio, a sequencer for non-professional musicians.

Alex Leavens and his partner, Shirley Russell, have designed and created more than 30 projects for Atari computers and game machines. One of their games, the parody adventure *Wombats I*, is currently in the Smithsonian Institution. At present Alex is working on an ST educational program for Jerry and Roberta Pournelle.

Alex got the impetus to write the START Desktop Icon Editor when he got tired of looking at the ST's standard Desktop icons. "I brought in the original version of the program to START's offices, and the editors said, 'Hey, this is great!' Then they paused, and said, 'Ya know, there're some changes you could make.' So I made the changes, came back, and they said, 'Hey, this is really great!' Then they paused, and said, 'Ya know. . .' This happened four times, but the final results are worth it." Alex and Shirley both graduated from the University of Chicago with a B.S. in Math and Sociology, respectively. They live in Fremont, California. ▶

Brian Lee bought his first computer, an Atari 800, in early 1981. After directing budgeting and expense control for The Gap Stores, Inc. he joined Synapse Software and established the Applications Product Division. He worked on the design and managed the development of SynCalc, SynFile+ and SynTrend for the Atari. In February of 1984 he took over running Synapse after its acquisition by Broderbund Software. After finishing the final consolidation with Broderbund he left and formed Forte, in conjunction with Mike Silva, author of SynCalc. Forte specializes in custom hardware and software development work for the IBM market. Brian and Mike have completed several dBASE projects and are currently working on a major consumer

software project. Brian holds an MBA in Finance.

Daniel Moore, along with partner Steve Ahlstrom, has written several programs for the 8-bit Ataris, including Paperclip and SynFile. He is also the co-author (with David Small) of "The Amazing Mousetrap" in START issue 2.

Dan recalls his first computer was a Hewlett Packard 2114B in high school: "It was the size of an extra-large, legal file cabinet and contained 8K words of memory. It used paper tape and a 30-line Fortran program took three hours to compile."

Dan attended the Colorado School of Mines. "We were six blocks from a Coors brewery and I remember waking up in the dorm, opening a window and taking a breath of Rocky Mountain hops." Dan is currently working on the Hometext portion of Russ Wetmore's HomePak for the ST, and on Paperclip Elite for the ST.

Howard Oakley is a doctor in the British Royal Navy, specializing in physiological research. He became involved with computers over ten years ago, and has since progressed from mainframes to micros. He has degrees from Oxford University, Cardiff and King's College, London. He served with the Royal Marines Field Hospital during the Falklands Conflict in 1982, then in 1984 spent nine months in the Antarctic, carrying out research during the Joint Services Expedition to Brabant Island. In his spare time he has run the expedition's database, first on an IBM PC XT and now on an Atari 1040 ST.

Dr. Oakley lives in an early-

nineteenth-century house in a rural part of the Isle of Wight, UK, with his wife and daughter. He particularly enjoys walking, camping and cross-country skiing, and has a large, all-encompassing library of books and software which threatens to take over his entire house.

David Plotkin, another of START's ST language experts, has written countless programs, in both BASIC and ACTION!, for our sister magazine *Antic*. In past issues of *Antic*, he has authored a series of beginner's programming tutorials. An engineer at Chevron USA, David designs and builds oil processing plants and offshore platforms. David recently had his first professional program, *Miniature Golf Plus* (for 8-bit Ataris) published by XLENT Software. Now, he is busily programming in Personal Pascal and hasn't turned on his 8-bit Atari in months.

David Small has contributed a wealth of technical articles to various computer magazines, including *Creative Computing*, *Antic*, and the first two issues of START ("Voodoo Computing" and "The Amazing Mousetrap" - the latter with Dan Moore). He has three books, including *Guidebook for Winning Adventures* (Buen Enterprises, N.Y., NY) which he co-authored with his wife, Sandy. Their fourth book was released in January.

David is also the developer of the Magic Sac (otherwise known as the Mac Cartridge), a plug-in card that allows your ST to run Macintosh software. He has worked for several computer companies and is now a consultant, freelance writer, and busy father of two children. ■

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THE START
DESKTOP
ICON EDITOR

CUSTOMIZE YOUR
DESKTOP ICONS!

By Alex Leavens

Kick out those old file cabinets and throw away your trashcan. With START's Desktop Icon Editor, you can replace your standard icons with whatever you want—a scroll, a wooden door, or even your favorite cartoon characters! Full GEM editing capabilities! Plus a desk accessory loader—find it all inside the ICON.ST folder on your START disk.



Folder ICON.ST
on your START disk



DESKTOP ICONS...

If you've used your ST for more than, say, thirty seconds, then you've seen icons. What? Aren't icons Russian religious artifacts that'll get you tossed in the gulag after some humorless *KGB agent* finds them in your luggage at Moscow Airport? Da, *tovarischch*. But don't worry, they're not the subject of this article. What I'm talking about are ST computer icons.

Icons on your ST are the small, bit-mapped graphics appearing on your desktop shortly after you boot up your machine. The first icons you see are filing cabinets, representing your disk drive(s), and a trashcan, representing your file delete function.

When you double-click on one of the drive icons, a window will open, showing the contents of the disk in that particular drive. The window then shows the remaining icons: a folder, usually a sub-directory representing programs with similar functions; a pile of paper with a dog-eared corner, representing, say, a resource file, or simply program data; and a memo pad, indicating programs executable from the desktop.

Icons gained their present foothold in computer operating systems for a very simple reason: Human beings are almost completely visually-oriented. In the past, people used their eyes to espy sabertoothed tigers from afar, and prevent said tigers from munching on them. Now, skip forward a few zillion years to the computer age. Before icons, people struggled with cryptic instructions on their PCs just to open files. With the advent of input devices such as mice, coupled with bit-mapped graphics, pictorial representations of computer hardware and software have made opening files easy. Now you just point and click.

But let's say you don't want to point and click on a dog-eared pile of paper. What if you want to click on the Banana Jr. 6000 character from *Bloom County* to run a program? What if you

want to trash a file by dragging it over to the gaping maw of *Sesame Street's* Oscar The Grouch? In order to accomplish these aesthetic transformations, you need a specialized program to alter your icons. You need . . .

THE START ICON EDITOR

There are a number of files which make up the icon editor, among them EDITOR.ACC, LOADICON.ACC, MAKEICN2.TOS, ICON.DAT and EDITME.RSC (see specific disk instructions in the sidebar and on the Disk Instructions Page). EDITOR.ACC is a desk accessory allowing you to do all sorts of wonderful things, which I'll tell you about in a moment. EDITME.RSC is the resource file for the accessory. MAKEICN2.TOS is a program executed at boottime by the accessory, and ICON.DAT is the icon image read in by MAKEICN2.TOS. LOADICON.ACC is a small desk accessory that will load your icons but won't let you edit them. In the second half of this article, I'll discuss the program take-apart, but first let's see how we edit icons.

CHANGING ICONS

Whenever you boot your ST, one of the first things it does (after loading in GEM) is to load and execute any files with the extender .ACC from your boot disk. These are desk accessories, which are really independent multi-tasking programs. There are many desk accessories already, performing such diverse tasks as checking your spelling and buffering files that you want to print. EDITOR.ACC is a desk accessory that at boottime, loads in a set of custom icons from a disk file. Once your ST is running, it also allows you to edit icons on the ST desktop.

Figure 1 shows a typical icon picture. By "coloring in" specific pixels on a 32 x 32 grid, we can form a picture. This is what the desktop does—each of the desktop icons is a series of on and off pixels which combine to form an image. For the desktop, these images are con-

tained in a file called DESKTOPRSC, which (in a ROM-based ST system) is located in ROM.

RUNNING THE PROGRAM.

At boot time, the editor accessory will try to open a file called ICON.DAT. This file should contain the custom icons you want loaded. If there is no file ICON.DAT, no icons are changed, al-

**What if
you want to trash
a file by dragging
it over to the
gaping maw of
Sesame Street's
Oscar The Grouch?**

though the accessory will still run. Once your ST has booted, the desk accessory ICON EDITOR will be available from the DESK menu. Clicking on this line will bring up the control panel for the accessory. From the control panel you EDIT the foreground mask, edit the BACKGROUND mask, CLEAR both masks, CLONE (copy) the foreground mask into the background mask, LOAD a foreground/background mask set, and SAVE a foreground/background mask set. You can also LOAD and SAVE an entire group of masks, which will load (or save) one of each of the five types of mask sets. (For a detailed explanation of masks, see the sidebar.) Here's a breakdown of each of the six functions:

EDIT: Edit the foreground mask of an icon.

The foreground mask of an icon is the actual icon picture—this is what will be displayed for a normal, unselected item on the desktop. When you click on this option, you will be put in the edit window, with a copy of whatever's currently in the foreground mask for this icon. (I'll explain the edit window in detail in a minute.) Note: The pictures you create using the editor will remain in the icon masks, even if you leave the desk accessory. This means that you could edit part of the picture, exit the accessory, come back to it later and your picture would still be there (assuming you haven't turned off your computer).

BACK: Edit the background mask of an icon.

The background mask of an icon performs two tasks. Before an icon's foreground mask is placed on the desktop, the background mask is logically OR'd with the desktop surface. Thus, whatever shape is in the background mask will show up as a hole on the desktop. Think of the background mask

in this sense as being a "cookie cutter" which will punch out a hole in the desktop, leaving only empty space.

Once the background mask has been used to punch a hole on the desktop, the icon mask is placed here. This is the normal, unselected state. However, when you single-click on an icon (or drag something to it, for example) the background mask comes into play again.

This time, the background mask is XOR'd (eXclusive OR'd) with the foreground mask. This is what gives us the "negative image" effect when you select an icon.

Editing a background mask works exactly the same way as editing a foreground mask. (The edit window is discussed in detail, below.)

CLEAR: Clear the current images from both the foreground and background masks.

You will be prompted with an "Are you sure?" message if you haven't yet saved your current images to disk. If you have saved your images, then the masks will simply be cleared.

CLONE: Copy the current foreground image mask (the icon itself) into the background image mask.

You use this function primarily when you're creating a new icon and want a basic pattern to work from to create your background. If there's something already in the background mask, you will be prompted with an "Are you sure?" message.

LOAD: Load an icon (or icon set) from disk.

Icon files are assumed to have a .DAT extender. There is nothing about an icon file that tells it which icon it should replace. That is, you can create a file icon, save it, and load it back in as a program icon or any other type of icon. Also note the program does not distinguish between single icons (created using SAVE of an individual icon) and icon sets (created using SAVE of ALL icons.) If you attempt to LOAD an icon set into a single icon mask, you will get the first icon image's foreground and background. Additionally, if you select load all and use a file with less than all images, you will get error alerts for the

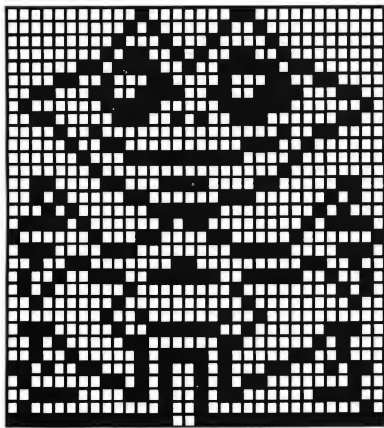


FIGURE 1.
A typical icon image.
(Design grid is 32x32.)



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DESKTOP ICONS...

icons which have no data. This is normal.

SAVE: Save an icon image (or set) to disk.

This works the same as LOAD, except that you're saving an icon (or icons) to disk. Note: Whenever you save an icon, a flag is also saved, indicating whether this icon is in use or not. (The program defines completely blank icons as being not "in use.") This flag is unimportant for single icons (you're not likely to be saving out blank space), but it is very important when you save out an icon set. This is because the program MAKEICN2.TOS (which is the actual icon loader/editor) looks at the usage flag for each of the icons it loads in, and edits the icon based on that flag. Here's an example.

With the icon editor accessory, I create a new program icon, a new file folder icon and a new text (non-program) icon. However, I don't do anything with either the disk icon or the trashcan icon. (I haven't loaded anything into them from disk, either). This

means that the file icon and trash icon are blank, while the program icon, the text icon and the folder icon are non-blank. Now I select SAVE ALL from the icon menu, and choose as my filename ICON.DAT. What happens?

- The file icon mask is marked as unused, and 128 bytes of zeroes are saved to disk.
- The trashcan icon mask is marked as unused, and another 128 bytes of zeroes are saved to disk.
- The program icon mask, being non-zero, is marked as used, and the images in the foreground and background masks are saved, foreground first (64 bytes), then background (64 bytes). The same thing happens for both the text and folder icons.

Now, when MAKEICN2.TOS is run (either from the desktop, by double-clicking it, or at boottime by the accessory), it will attempt to load in ICON.DAT. Once it does, it discovers the images for the file and trashcan icons are unused. It

then searches through memory and replaces only the icons which are used (in this case, the program, text and folder icons).

USING THE EDIT WINDOW

We've examined the main menu functions of the icon creator. Now let's take a look at the actual icon editor built into it. Figure 2 shows what our icon editing window looks like. You'll notice several things about our window:

- At the top is the name of the icon mask we're currently editing, such as "File Icon Mask" for the foreground mask of the file icon, or "Trashcan Icon Background" for the background mask of the trashcan icon.
- On the left of the screen is the actual edit window. This is the area you will either PAINT or DRAW or make a LINE in.
- In the middle top of the screen you'll see three small boxes. The top-most box corresponds to our edit window—this is where you'll see a real-size image of the one that you're creating. This is how the ▶

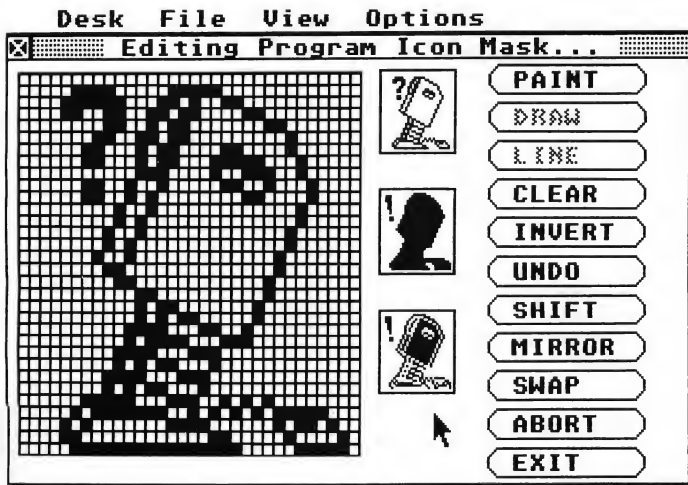


FIGURE 2. Your Desktop Icon editing screen.

DESKTOP ICONS...

How the Desktop Draws Things

Throughout most of this article, I've yammered on about foreground and background icon masks, with nary an explanation of what the darned things actually are. Never fear, an explanation is at hand.

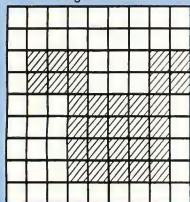
Whenever the Desktop draws itself, it does a couple of things. First,

it draws a solid background pattern. This is the pattern appearing when there's nothing else such as an open window or an icon to interrupt it. On color monitors (w/ TOS in ROM), this pattern is simply solid, all pixels on (and, if you haven't altered the desktop palette color,

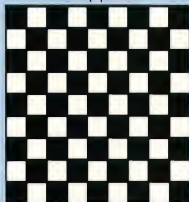
green). On monochrome monitors the pattern is a little more complex, and is known as a "dithered" pattern, consisting of one pixel off, one on, one off, etc. Think of it as hundreds of little checkerboards, all linked together. OK, the Desktop has drawn the background. Next, it

FIGURE 1.

Background mask.



Desktop pattern.



Resulting Desktop. (Selected icon.)

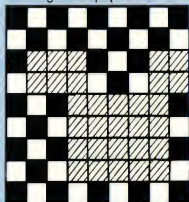
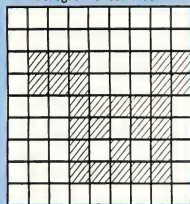
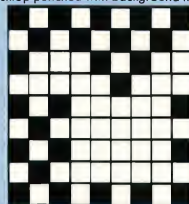


FIGURE 2.

Foreground icon mask.



Desktop punched with background mask.



Final unselected desktop image.

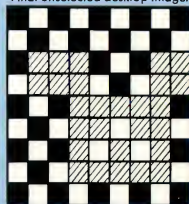
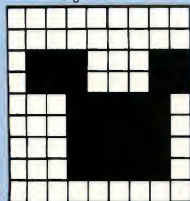
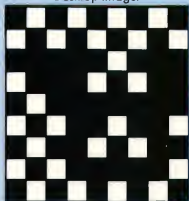


FIGURE 3.

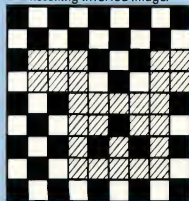
Background mask.



Desktop image.



Resulting inverted image.



draws the icon images for disk drives and the trashcan, and then draws any open windows. It's the second stage of this process we're interested in.

Remember: our icon image is nothing more than a pixel pattern 32 bits wide and 32 lines high. If we simply dropped this image down on the desktop, without regard to what was underneath, the results would be, at the very least, unaesthetic. This is what will actually happen if you create an icon image with no background mask. It'll just get slapped onto the desktop any old way, and it looks very ugly. . .

So what we need is something to clear out a space on the desktop before we plop our icon image there. This is what the background mask is for. Let's take a closer look at the actual process of drawing the icon mask on the Desktop. (Note: To avoid confusion, when I'm speaking about the desktop program, I'll say GEM. When I'm referring to the actual physical Desktop on the screen, I'll say "the Desktop.")

Step 1: GEM takes a copy of the background mask for an icon, and does a "replace" function with it on the Desktop. Wherever a pixel in the background mask is ON, the corresponding pixel on the desktop will be turned OFF (set to the background color, normally white), with-out regard for what that Desktop pixel was originally. If a pixel in the background mask is OFF, then it has no effect on the desktop (See Figure 1). Note how the little figure has effectively punched a hole in the desktop pattern.

Step 2: GEM takes a copy of the foreground mask for the icon (usually just called "the icon," and uses it to do a "replace" function on the Desktop (See Figure 2). Notice how it's difficult to see the edges of the final icon—they just seem to blend in with the desktop. Because of this, it's a good idea to make your background mask at least one pixel bigger than your image. That way, you'll be cutting out some "white space" around your image, so that the edges of it will be visible. See the icon images on your disk for examples of this.

This is the normal, unselected state of an icon. But what happens when you single-click on an icon, or cause it to be highlighted (like dragging something to the trashcan, for example). The same two steps listed above are performed. Then a third step takes place, which is:

Step 3: GEM takes a copy of the background mask, and performs an exclusive OR with the current desktop image. An exclusive OR does the following:

- If both pixels are ON, the resulting pixel is OFF
- If one pixel is ON and one is OFF, the resulting pixel is ON
- If both pixels are OFF, the resulting pixel is OFF

The result is an inverse image of the original pixel image (See Figure 3). Note that wherever the image was ON now contains whitespace, but the three pixels (the "eyes" and "nose" of our little figure) which were off are now ON.

icon will look on the desktop. The middle box corresponds to the other mask of the icon you're currently editing. Thus, if you're editing the foreground mask of an icon, the background mask will be displayed here. Similarly, if you're editing the background mask of an icon, the foreground mask will be displayed here. The lower box shows what happens when the foreground and background masks of the icon are put together. In other words: The image which will result when you select the icon. Where AND and XOR are logical bit operations, the process used to determine this window is:

(Foreground mask AND Background mask) XOR Background Mask.

On the right hand side of the edit window you'll see eleven buttons. These are: PAINT, DRAW, LINE, CLEAR, INVERT, UNDO, SHIFT, MIRROR, SWAP, ABORT and EXIT. They perform the following functions:

- PAINT, DRAW and LINE are toggle buttons to select the drawing mode for editing. The current mode is displayed by the button in normal text—the other two modes are displayed in lightened text. Any of the buttons may be clicked at any time. Clicking a button that's already active has no effect. When in PAINT mode, pixels will be drawn in the edit window as long as you hold the mouse button down and move the mouse. Painting stops when you release the button. The color you're PAINTing in is determined by the color of the pixel that you first click on. If you click on a white (empty) pixel, you'll be painting in black. If you click on a black (filled) pixel, you'll be painting in white. PAINT mode is useful for drawing large outlines and filling in spaces.

For detailed editing work, use DRAW mode. In DRAW mode, you turn pixels on and off, one at a time, by pointing to a particular

DESKTOP ICONS...

pixel and clicking on it. Clicking on a blank pixel will turn it on, and clicking on an activated pixel will turn it off.

LINE mode is used for drawing lines. When you first click on a pixel, you mark that pixel as being the starting point of your line. Then, as long as you hold down the button, you'll have a rubber-band line that follows the mouse around the screen. When you release the mouse button, you define the ending pixel for that line. The program then draws a line between the two points. (Note: Since the program uses integer math in drawing a "best fit" line, it may not always be perfect.)

- CLEAR will clear the edit workspace. You will be prompted with an "Are you sure?" message.
- INVERT reverses the current image (black pixels are turned to white and white pixels are turned to black.) Useful for creating background masks.
- UNDO works intuitively and undoes the last operation you performed. You can also use the UNDO key on the ST keyboard. You have 9 levels of UNDO, which means you can undo the last 9 previous functions.
- SHIFT gives you the ability to shift the entire image one pixel in any direction (up, down, left, or right). Very useful for when you thought you had that image centered. The arrow keys on the keyboard also activate this function.
- MIRROR allows you to draw with mirroring on, similar to DEGAS and DEGAS Elite. The best way to understand this feature is to play with it!
- SWAP allows you to switch to editing the other icon image. If you're editing the foreground image, you would start editing the background image and vice-versa. You will be prompted with an "Are you sure?" message.
- ABORT will allow you to abort your current edit, leaving the current icon you're working on unchanged. You will be prompted with an "Are you sure?" message.
- EXIT exits the editing process and copies the contents of the edit buffer

into your icon buffer.

In addition to the control panel features, there's another function which is not listed, but instead accessed through the mouse. This is the "Area Select" feature, and is used in conjunction with the CLEAR, INVERT and SHIFT functions. Normally, these functions work on the entire image that you're editing. However, you can also select a smaller area for these functions to work on.

While pressing the RIGHT mouse button down, move the mouse cursor to the pixel that you want in the upper left corner of your selected area. Now press the LEFT mouse button down. (Once you've pressed the left mouse button you can release the right one.) You should now see a rubber box sitting with its left corner where you clicked the mouse. Now, as long as you hold the left mouse button down, you'll be able to drag the rubber box around. Once you release the mouse button, the box will snap inwards to the nearest pixel boundaries and highlight that area. This is your selected area. You can now use the CLEAR, INVERT and SHIFT functions, and they will *only affect this selected area and not the entire image.*

The selected area will stay in effect until you (1) cancel it explicitly by pressing on any area outside both the edit window and the buttons or by selecting a new area, or (2) Cancel it implicitly by starting to paint, draw, or draw a line.

As a final note, avoid selecting any options from the menu bar when in edit mode. To make updates more efficient, I ignore most GEM redraw messages. Hence, if something overwrites the edit window, it'll stay there. If you insist on trying this, any key (except UNDO or the arrows) will force a redraw and repair the window.

INSTALLING NEWLY-CREATED ICONS

You'll note that once you exit the START Icon Editor (from the QUIT option in the main menu), none of your icons

have been changed. This is normal. The Editor is simply an icon editing tool. In order to actually change the icons on your desktop you must:

- 1) Create new icon(s) and/or load old ones from disk.
- 2) Save out all icons, in a file named ICON.DAT. (If you already have an ICON.DAT file, you can save it out as something else, and rename it as ICON.DAT later.)
- 3) Exit the Icon Editor.

If you already had an ICON.DAT on disk and saved your new icons as something else do the following: Single-click on ICON.DAT. Type the letter "X." Type RETURN. You've now renamed ICON.DAT to be ICON.DAX. Next, single click on the filename you just saved. Hit [ESCAPE], then type ICON.DAT followed by a [RETURN]. You've now renamed your other file to be ICON.DAT. +) Double-click on MAKEICN2.TOS. This program will read the file ICON.DAT, and install the new icons you've created.

Hurrah! You're finished. Now, let's see how this stuff works.

HOW NOT TO BOOT A 22K DESK ACCESSORY EVERY TIME

Also included on your START disk is a program called LOADICON.ACC. This is a very small desk accessory performing only one function: It loads in your custom icons at boot time. Once you've created a set of icons you like, you can remove EDITOR.ACC from your boot disk, and replace it with this one. (Of course, you won't be able to edit icons then.)

ICONS, GEM AND THE DESKTOP

The ST desktop icons are contained in a file called DESKTOP.RSC, which (in a ROM-based ST system) is located in ROM. Yes, you're right. DESKTOP.RSC is the desktop resource file. This brings us to a little-known fact about the desktop: It's just another GEM program, like any

other. It makes calls to the AES and VDI libraries, accesses DOS, and reads the mouse using `evnt_multicalls`. It has a resource file, too, where it gets the menu bar you see on the desktop, where it gets other information, and where it keeps all the information needed by the desktop.

But, how can our program alter desktop images stored in ROM? It can't, of course. However, when you boot your machine, one of the first things TOS does is copy `DESKTOPRSC` down into the low memory of your ST. Then, when the desktop program is started up, it gets its information from the RAM copy of the resource file and not out of ROM.

When I wrote this program, I thought, "All I have to do is find the copy of `DESKTOPRSC` in low memory, and change the icon pictures to whatever I want!" Unfortunately, it wasn't that simple.

The first stumbling block is the fact you can't predict exactly where the resource is going to be loaded. All of the following things (and others) affect where `DESKTOPRSC` finally ends up: How many drives (both physical and logical) you have, whether or not you have a disk cacher program installed, how many accessories you've got and how much memory your machine has. It's loaded into the general area at `0x10000` ("0x" is a C sign for hexadecimal numbers)—but it can be higher or lower than that, sometimes by as much as `0x2000` bytes! This means that we're going to have to search for it every time we boot the machine.

`MAKEICN2.TOS` does exactly that. It loads in and then, starting at `0x50000`, searches downward through memory for the string `DESKTOPRSC`. Once it finds it (and if it doesn't find it, there's something seriously wrong!), it calculates the offset from the beginning of the resource file to the place where icon images are kept. This is a fixed number (at least for this release of the GEM ROMs), arrived at through experimentation—this value is not one that Atari

guarantees to be the same in future releases. This means that `MAKEICN2.C` will not necessarily work with future releases of the ROMS... but by that time, I'm sure I'll have figured out where the new icon images live.

Anyway, the problem of finding the images in memory was insignificant compared to the second one: The desktop program loads the icon images it needs out of the resource into another area of memory, and thereafter doesn't look at the resource unless it tells itself to. In other words, at boot time, the

Think of the background mask as a "cookie cutter."

desktop makes its own copy of the icon images, and never looks at the resource file again, unless it absolutely has to. And unfortunately, our changing the images in the resource file doesn't qualify.

Let me explain further: After some fooling around, I'd managed to write a simple little program which went down into low memory, found the `DESKTOPRSC`, determined the offset from the start of the resource file to the start of the actual icon images, and then patched the images to be something else. I had no tools for actually building a data file of images—the program I wrote simply had a different image (a floppy disk) coded into it, which it used to replace the file cabinet image. I drew the disk image by taking a piece of graph paper, plotting it out, and then converting that plot into integers, which I stored in an array. But back to the story.

Now I had this program, which I would execute from the desktop. Double-click on it, it would execute, then leave, the desktop would come up again. And voila! there was the image I had stuffed in—a little 3.5" disk instead of Atari's filing cabinet. Great! I thought. I'll just write a little desk accessory which will execute this program at boottime. I won't have to change anything at all. Wrong, wrong, wrong. I wrote a pathetically simple desk accessory. All it did was:

```
event_timer (4000, 0); /* Wait  
for 4000 milliseconds */
```

```
Pexec(My little program); /* Exe-  
cute my icon program */
```

```
loop: Goto loop; /* simply wait  
for ever, since */
```

```
/* desk accs never end. . . */
```

(`Pexec`, by the way, is simply a DOS call that allows you to load and execute another program.) Now I ask you: How much simpler could things be? Not much. And my accessory worked, too: The machine would boot, the desktop would come up, and 2 or 3 seconds later, the drive light would come on, indicating my little program was being loaded and executed. But nothing happened. The desktop icons remained unchanged. What was going on? I examined low memory with a debugger, and sure enough, my program was working—the icon had, indeed, been changed. So why hadn't the changes shown up? And then to further confound me, when I exited the debugger, there was my icon staring me in the face! Aaaargh! What was going on?

I finally figured it out: The Desktop, instead of going to the resource each time it wanted to draw an icon, was going there just once, copying the icons somewhere else and using that copy ▶

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DESKTOP ICONS...

from then on. There was no way to force the Desktop to go back to the resource, ever. The only time it would do it was when you executed something from the Desktop, like running a program, or showing a file. After you run a program, the desktop decides whatever information it has lying around is hopelessly scrambled, and goes and gets a fresh copy of everything it needs from DESKTOP.RSC. Of course, once it does that, it now has a copy of your new icon, and so the new image shows up on the Desktop.

Unfortunately, there was no method—no system call, for example—I could've used to force the Desktop to look at DESKTOP.RSC, after it had looked at it the first time. And once I phrased it that way, the answer became obvious: Sure, there was no way to get it to look at the resource again *after* after it had already looked at—but how about *before* it had looked at it? Was there a way I could get at the resource file before the Desktop did?

In a word, yes. When your ST first

boots, there is a very brief period after DESKTOP.RSC has been copied into low memory, but the Desktop hasn't yet been executed, and thus the Desktop hasn't had a chance to load the icon images out of the resource. If I could get to the resource file during that time, then I could alter the icon images, and they would be used by the desktop from the beginning. After about a day of experimentation, I came up with a timer value for my desk accessory that was long enough so the DESKTOP.RSC had been loaded, but short enough so the desktop itself hadn't yet read the images out of it.

After that, it was relatively easy. I had built a series of images by hand, and I had a little loader program (MAKEICN2.TOS) which would load them in. Now what I needed was a tool to let me edit those images, save them to disk and load them later. So, how long was it going to take to write that program?

Would you believe less than 48 hours?

PROGRAMMING MADNESS: (Or, how to write a 2000+ line GEM program in less than 2 days)

I know what you're thinking: There's simply no way I could've written, compiled, and debugged all the code in EDITOR.C in less than 48 hours. I admit it: First, I stole a couple of the routines from other places, and second, some of the auxiliary routines (like the stuff handling the buttons inside the edit window) I wrote over the next several days (bringing the grand total to 1 week of programming). Most notably, I stole `sho_1form()`, a very handy little utility for displaying dialog boxes. I also stole the basic shell of an accessory from the Atari Developer's Kit, but I gutted it so much only about 50 lines were left. The fact remains I wrote, compiled and debugged something like 1900 lines of C code in less than two days (and 90% of the code was written in a single frenzied 12-hour programming session). And this points to one of the reasons I like GEM so much: It's easy to write effective, useful programs, in a short amount of time.

WHAT IT ALL MEANS

Actually, there is no cosmic significance to this program, but I've had a lot of fun creating it and playing with my Desktop. You'll find the Desktop icons that I use in the ICON.DAT file on your START disk. Use them as a starting point to see how to create little animation tricks (in particular, look at my program icon), and just have fun. I hope to see lots of custom icons floating around soon! (Editor's note: For oodles and oodles of the best icons, look on our own Antic ONLINE. Type GO ANTIC at any CompuServe prompt. For more information on CompuServe Information Services and Antic ONLINE, circle 163 on the Reader Service card.)

Lessee... I'll trade you two program icons for a trashcan. ■



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The START Ray-Trace Construction Set

Awesome do-it-yourself graphics!

by TOM HUDSON CONTRIBUTING EDITOR



Ray-tracing, the earmark of \$25,000 graphic workstations, comes to the ST. Follow Tom Hudson, author of *DEGAS Elite* and *CAD 3-D 2.0*, into a surreal spacetime, where chrome spheres and checkered rooms abound; beams of light are stretched through a 3-dimensional computer world; and the Atari ST is pushed to its outer limits. ▶

 Folder **RAYTRACE.ST**
on your START disk

Ray-Trace...

One of the most exciting areas in computer graphics today is the use of a technique known as "ray-tracing." This computationally intensive technique, though time-consuming, can produce stunning images, and until recently was only practical on dedicated graphics systems with powerful processors.

Fortunately for us, the Atari ST has the computing power and the graphics features which make ray-tracing possible on a personal computer. The images still take a while to calculate, but the results are well worth it.

The program TRACER.PRG, in the RAYTRACE.ST folder on your START Disk, will allow you to generate your own impressive ray-traced images with a minimum of work. Its batch control-file allows your computer to create multiple images and save them to disk automatically (for a large number of images, you can actually let your system run overnight completely unattended).

If you have a set of the LC Technologies STEREO TEK glasses, you can even create stereo pairs of a scene for a true 3-D image!

ALL ABOUT RAY-TRACING

To learn about ray-tracing, you must think about how your eyes normally work. Light rays from the sun or another light source illuminate an object and are reflected in many directions. Some of these light rays eventually reach your eyes, impact on the retina, and are relayed to your brain.

In computerized ray-tracing, it's a little easier. Instead of going from the light source to the objects to the viewpoint, we can start at the viewpoint and "look" out into the scene. In this process, the screen of the computer is an imaginary plane positioned in front of the scene (see Figure 1).

This process is simplified by the fact that a computer screen is made up of square pixels. We simply follow the line (or ray) from the viewpoint through each pixel's location on the screen and out into the scene. When the ray hits something, we can check the color of the object hit by the ray and place that color in the pixel the ray passed through. When this process is repeated for each pixel on the screen, you have a complete image of the scene.

The interesting thing is, you don't have to stop with simple objects. Using the mathematical formulas for the reflection of light, we can make certain objects in the scene reflective. When the ray hits them, we simply calculate the new direction for the ray and continue following it. Figure 2 is a photograph of a ray-traced scene which contains three mirrored spheres of different sizes, created on an ST computer. Note that the walls (images created with the DEGAS Elite paint program and the Computereyes color digitizer) are reflected in the spheres, and the two smaller spheres are actually reflected in the large sphere!

TRACER.PRG allows you to create your own scenes like

Figure 2. You can have up to 20 mirrored spheres of different sizes anywhere in the scene, and you define the colors and the images used on the walls of the "room." You also determine the position of the viewpoint so you can create different perspective effects. It will create beautiful three-dimensional ray-traced images in the low-resolution, 16 color graphics mode. It will not run in monochrome mode.

HOW IT WORKS

To generate an image, the program creates an imaginary room in the computer's memory. Each wall of the room is a 320 X 200, 16-color picture taken from a DEGAS picture file. The ceiling and floor are both 320 X 320 checkerboard images which are automatically generated. The room's layout is shown in Figure 3.

As you can see, the room is a 320 wide by 200 tall by 320 deep area. The left wall is at X coordinate 0; the right wall is at X coordinate 320. The floor is at Y coordinate 0; the ceiling is at Y coordinate 200. The front wall (the wall you're "looking through") is at Z coordinate 0; the back wall is at Z coordinate 320. As you can see by the image in Figure 6, the various walls show up in perspective, and the front wall is visible only by its reflection in the spheres!

The program's operating principle is simple. Four DEGAS-format picture files are loaded into memory. Because all four pictures will be displayed on the screen at one time in the

**The program
will allow you to
create your own
ray-traced images.**

ray-traced image, they must all use the same color palette. This is a tough restriction, but with judicious use of colors you can create very appealing images. The image in Figure 2, for example, began as a Computereyes color digitized photo of a girl (the picture is available on the Computereyes demonstration disk as DEBBIE.P11). I loaded DEBBIE.P11 into DEGAS Elite and created a new color palette for the image, placing the reddish skin tones on one end of the palette, and an attractive violet color group on the other end. The DEBBIE image was then "re-mapped" to use the colors I had selected, and saved as the picture for the front wall. The three bitmaps for the other walls were created with the same colors as the DEBBIE picture and saved to disk.

The color palette setup is important. The leftmost four colors on the palette are used to draw the floor of the room, with the first color in the palette being the brightest. Colors 0 and 2 are used to make the checkered pattern, and colors 1 and 3 are used to make shadows (shadows on color 0 are made with color 1; shadows on color 2 are made using color 3). Because of the way the program generates the images, you should have at least six colors in the group making up the floor (see Figure 4 for an example palette).

The best situation you can have when setting the colors for your ray-tracing palette is to have only a couple of colors with a large number of shades of that color. The palette in Figure 4 has only two main colors, but the brightness values range from bright to dim. Having more colors can produce a more colorful image, but may not allow you sufficient shading ability. You'll probably want to find a happy medium between the number of colors and the number of shades of each.

Once the computer knows which images it needs to make the walls, it sets up a user-defined number of spheres in the room. The spheres can be any size, as long as they do not go outside the room's dimensions.

CREATING IMAGES

On the START disk, you'll find a file called EXAMPLE.CTL. This is an example ray-tracing control file. It's a good idea to print the EXAMPLE.CTL file on your printer or load it into a text editor program so you can follow along with the description of the file.

The control file is a simple text file which the TRACER.PRG program uses to describe the "room" being ray-traced and the contents of the room. Any line in the file beginning with a semicolon (;) is treated as a comment and is ignored. This is very convenient because you can add descriptive notes to your control files for later reference. In fact, the example control file already has comments telling the function of the parameter line following the comment.

Lines requiring numeric input are entered very simply. Just type the number you want to enter on the line. Don't use any non-numeric characters. Some parameter lines will require more than one value. In this case, just type the numbers, separating them with a single comma. To enter a parameter with the numbers 13, 200 and -30, you would type:

13,200,-30

You can edit the control file with any text editor or a word processor which will edit program text files without doing any text formatting (1ST Word is ideal, just make sure you're not in word processing mode). Be sure to save the file with a CTL extension on the filename. For example: TEST1.CTL.

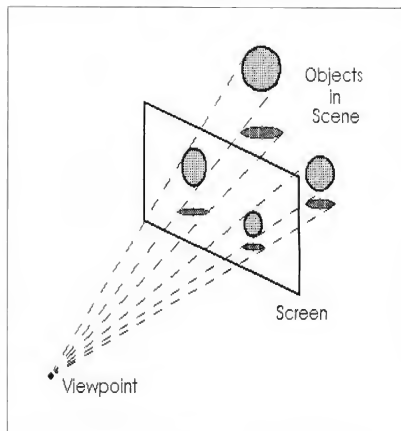


FIGURE 1

THE PARAMETERS

The first parameter in the control file is a number that tells the computer how many times to reflect the ray if it keeps bouncing off objects. This value must be at least 1, and I recommend that you set it to no less than 3 for a good effect. The example control file uses a value of 10. The more reflections you allow, the better your scenes will look, because the spheres will reflect other spheres, which are reflecting other spheres, and so on, producing an extremely realistic image. The maximum value allowed is 10. Having a large number of reflections means the image will take somewhat longer to generate because the program must follow the ray for a long distance.

Figure 4 is the color palette used by the wall images in the example control file, which created the image in Figure 2. The colors in the palette are numbered from 0-15. These values are referred to in the next three parameters.

The next parameter is the "infinity color," which is the color register number (0-15) the computer will use if the ray reflects the maximum number of times. I suggest setting this to the darkest color in your color palette. The example control file uses an infinity color of 15, which, as you can see in Figure 4, is black.

The next section of the control file is a table telling the computer the relationships between the colors in the palette. Specifically, it gives the information needed to dim the colors for each successive reflection. Each color register has a pa-

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Ray-Trace...

parameter line which gives the palette color number used for each reflection. The number of entries on each line must match the number of reflections specified earlier, which in this case is 10.

Looking at the color palette and the dimming table, you can see that the first color in the palette (color 0) uses color numbers 0 (no reflection), 1 (1 reflection), 2 (2 reflections), 3 (three reflections), 4 (four reflections), 5 (five reflections),



FIGURE 2

and 15 (black) for the sixth through ninth reflections, because there is no darker violet shade in the palette. The tenth reflection will use color 15, the "infinity" color specified earlier.

Similarly, the third color in the palette (color number 2) uses color 2 for no reflection, color 3 for one reflection, color 4 for two reflections, and so on. The tenth reflection is always treated as the infinity color.

As you can see in Figure 4, the palette has two groups of color, a violet group and a red-orange group. Colors 0-5 are violets, colors 6-14 are reds and color 15 is black. The red group (including the black color), 10 color registers, gives us the maximum practical number of reflections the palette can handle. As you can see in the dimming table for color 6, the dimming sequence is 6-7-8-9-10-11-12-13-14-15.

Each color in the palette is given a dimming table because each time the ray reflects off an object, the reflected color is dimmed slightly to simulate the light loss seen in the real world. You must tell the system how all the colors are related so that it can do the dimming automatically. This is simply a process of looking at the color palette used by the wall images and linking the related colors together, starting at the brightest and moving to the darkest.

Another possible color palette is shown in Figure 5. This palette has a set of six red colors defined for the floor (0-5) and has two groups of other colors, five blues and four greens, with the last color in the palette set for the infinity color, black. To generate a room with this palette, the parameters would be:

```
;Ray bounces:
6
;Infinity color:
15
;Palette dimming indexes:
;REDS:
0,1,2,3,4,5
1,2,3,4,5,15
2,3,4,5,15,15
3,4,5,15,15,15
4,5,15,15,15,15
5,15,15,15,15,15
;BLUES:
6,7,8,9,10,15
7,8,9,10,15,15
8,9,10,15,15,15
9,10,15,15,15,15
10,15,15,15,15,15
;GREENS:
11,12,13,14,15,15
12,13,14,15,15,15
13,14,15,15,15,15
14,15,15,15,15,15
15,15,15,15,15,15
```

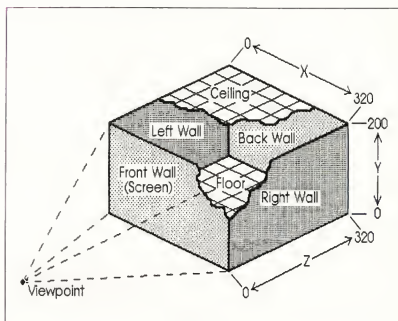


FIGURE 3

In this example color palette and the control file entries, you can see that the colors are grouped into reds, blues and greens. Figure 6 shows an image created with this palette. Using this method, you can build custom color palettes containing several groups of color, in any order.

The next parameter, which also uses the color numbers from the color palette, tells the computer which two colors in the palette to use for the ceiling of the room. The ceiling is a simple checkerboard pattern made of two colors, and is created automatically by the program. In Figure 2, the colors ▶

Ray-Trace...

used for the ceiling are number 6 (yellow) and number 9 (red). Since the values given here are color registers, they must range from 0-15.

The next section of the parameter file is repeated for each frame you want to generate. This is the data that determines 1.) how many spheres there are, 2.) where the spheres are located, 3.) what images to use for the walls, and 4.) the filename to save the ray-traced image under. If you want to generate three images, you simply supply this information three times. The EXAMPLE.CTL file is set up to build two frames.

The first frame parameter is the observer's viewpoint. This is a three-number parameter which specifies the X, Y and Z coordinates of the viewer's eye. The X and Y values can be located almost anywhere, but for most images the X value should range from 0 to 319 and the Y value should range from 0-199, so that all the walls can be seen. The Z value must be a negative value. The example control file has a viewpoint X coordinate of 150 (just left of center), a Y coordinate of 170 (slightly below the ceiling) and a Z coordinate of -450. If the Z coordinate is moved toward zero, the perspective effect becomes more dramatic; if moved away from zero, the perspective effect is lessened. Try changing the Z value and you'll see the change in perspective.



FIGURE 4

The next parameter is the number of spheres in the scene. As you can see in Figure 2, this value is set to 3. You can have as many as 20 spheres in the room (crowded!), or none at all (boring!). For none, enter a zero here.



FIGURE 5

The program has to know how large each sphere is, so the next parameter tells the radius of each of the spheres. In this case, the spheres are 90, 40 and 30 units in radius, respectively (giving diameters of 180, 80 and 60 units). Because the room is only 200 units high, the maximum radius of a sphere is 99 units (giving a diameter of 198). The program will tell you if a sphere is too large to fit in the room. The smallest

recommended size for a sphere is a radius of 30 units, but you can make them as small as you like (down to one unit). If you have spheres smaller than 30 units, the program will run more slowly to ensure that it does not "miss" the smaller spheres. You have been warned!

The two smaller spheres are actually reflected in the larger sphere

The next parameter is a list of the X coordinates of the centers of all the spheres. These values must be such that the sphere remains inside the room's limits. For example, if a sphere is 20 units in diameter, the X coordinate can range from 21-299 (placing the edge of the sphere at 1 or 319, respectively). If a sphere's centerpoint is placed such that the sphere hits one or more walls, the program will tell you about the error. Spheres can overlap without incident, though—the program handles it nicely, and the effect can be very impressive!

The next parameter is a list of the spheres' Y coordinates. This is similar to the X coordinate list, but the spheres' Y limits range from 1-199 because the room is only 200 units high.

The next parameter, similar to the X and Y lists, is the list of Z coordinates of the spheres. The Z limits, like the X limits, range from 1-319.

If you're generating a room with no spheres, just enter a single zero for the X, Y and Z coordinate lists.

The spheres in the EXAMPLE.CTL control file range as follows:

- Sphere 1: X=70-250, Y=10-190, Z=70-250
- Sphere 2: X=200-280, Y=10-90, Z=30-110
- Sphere 3: X=10-70, Y=120-180, Z=70-130

The next four parameters are the *full file* pathnames of the files for the left, right, back and front wall images, respectively. To make a full pathname, you need the drive specifier, the folder names (if any) and the filename plus extension. In the example file, all the images are in a folder called PICTURES on drive E:. The pictures must be stored in uncompressed DEGAS format (you programmers out there can modify the program to load any picture type you like). All four pictures must use the same color palette so they look correct when

used together. If you use different palettes in your pictures, the output will use the color palette from the "front wall" picture, and the other walls may appear strange.

The last parameter for the frame is the filename under which to save the ray-traced image when it's complete. The image will be saved in uncompressed DEGAS format. Like the wall image parameters, this parameter must supply the full pathname of the file, including the drive and folder names (if any). If you don't supply the drive, the picture may not go where you want it. In the example file, the ray-traced image will be saved as RAY1.P11 in a folder called GRAPHICS on drive C:. Before running the program, be sure the drive where you'll be saving your images has enough room (approximately 33K per image).

This structure can be repeated as many times as you like to create a large number of frames, each with different sphere numbers, sizes, and even wall images. The EXAMPLE.CTL control file continues on to make a second image, with a different viewpoint, and saves it as RAY2.P11. The STEELY-BOINK! animated demonstration, which I created with the TRACER program, used several different wall images in sequence to create an animated image on each wall. There are 30 frames total in the animation sequence, and to generate all these frames took an ST 25 hours of processing. Fortunately, the automatic nature of the TRACER program allowed much of this processing to take place overnight, completely unattended.

One other convenient feature of the control file structure is that those readers with STEREOTEK glasses can easily create stereo pairs of the room for true 3-D images! Simply create a control file that generates two identical frames, but set different X values in the viewpoint (to simulate the slightly different horizontal positioning of your eyes). For example, a good left-eye viewpoint might be 150,170,-450, and a corresponding right-eye viewpoint would be 180,170,-450. Stereo image pairs can be created in under two hours and viewed with the STSLIDE.PRG program (available on CompuServe's SIG*Atari forum; type GO ATARI16 at any prompt), and the results are simply stunning!

FIGURE 6



BAILING OUT

Once you start the TRACER program, it asks for the name of the control file with a GEM item selector box. Once you tell it which control file to use, the program reads the parameters and checks for errors. If an error is found, the program displays the line with the error and tells you about the problem. You'll have to re-edit the control file and re-run the program. If there are no errors, the program begins the ray-tracing process.

Before the ray-tracing begins, you'll see the screen clear. Then, if you have spheres in the room, several circles followed by squares will be drawn on the screen. This is the program building the floor of the room with its checkerboard pattern and circular shadows. This is normal. After completion, the screen will clear, ready for the final image.

If the Z coordinate is moved toward zero, the perspective effect becomes more dramatic.

The ray-traced image will be drawn from left to right on the screen, one pixel at a time. Go and get yourself a snack or peruse other articles in this issue of START because the average frame generation time is approximately 50 minutes. You can watch the progress of the program as the image is created.

If there is a problem (a misplaced sphere or the wrong filename for one of the walls), you can abort the program with the UNDO key. If you have a control file with several different images, pressing HELP will skip to the next image in the control file. If you have built a control file to generate a large number of images and you want to leave the computer unattended to do the job, run the program once using the HELP key to skip each image. Each image's control parameters will be checked and you can catch errors ahead of time. If no errors show up, you can run the program again with confidence that you will not get a parameter error.

After the program has generated the image and saved it to disk, you can load it into a paint program to add text, touch up the image manually or add details. Again, though, the picture is in DEGAS format. If you own another paint program (e.g., NEOchrome), there are a number of conversion utilities available in the public domain, or see Patrick Bass' *Grafcon ST: The Universal Graphics Converter* (Antic, July 1986).

Have fun using the TRACER program. It really shows how the ST's graphics can shine. ▶

Ray-Trace...

DETAILS, DETAILS

If you're a programmer, you'll be glad to know the source files for the TRACER program (TRACER.C and TRACEASM.S) are included on the START disk in the RAYTRACE.ST folder. You can modify the program as you like, to load other types of bit-mapped images for the walls or ray-trace other kinds of objects. The source files are packed with helpful graphics routines.

The code is commented heavily, so I won't go into laborious detail about everything it does.

The first section of the program takes care of reading the control file and parsing out all the information. This section uses several functions to get the job done.

The `getparm()` function retrieves the next non-comment line from the control file and returns it in the specified string. The `ascint()` function converts a numeric string into a WORD value. The `iaparse()` routine parses a string containing numbers separated by commas, placing the parsed values into a programmer-specified WORD array.

The DEGAS-format images are loaded into four 32,000-byte arrays by the `loadmap()` function. All four images must be placed into memory so the program can get pixels from each as required. To load pictures other than uncompressed DEGAS pictures, just change the code in this function.

$$\bar{V}' = \frac{\bar{V}}{|\bar{V} \cdot \bar{N}|}$$

$$\bar{R} = \bar{V}' + 2\bar{N}$$

Where:

- \bar{V} = The ray's vector before reflection
- \bar{N} = The normal of the reflecting surface
- \bar{R} = The ray's vector after reflection
- \bar{V}' = The angle between the ray and the reflecting surface's normal

FIGURE 7

Once the walls are loaded, the program creates a special 320×320 bitmap for the floor, containing a checkered pattern and the shadows of the spheres. The scene is lit by an imaginary light source positioned directly above the room. The floor bitmap is made by plotting the sphere shadows (circles) onto the screen in two passes (necessary because the screen handler won't plot beyond the 200-pixel height limit), copy-

ing these bitmaps to the floor's buffer (`botbuf1`), then ORing a checkered bitmap with the circles. Since the shadow circles are plotted in color 1 (VDI index 2) and the checker squares are color 2 (VDI index 3), the floor takes on color 0 (no

You can easily create stereo pairs of the room for true 3-D images!

shadow or square), color 1 (shadow with no square), color 2 (square without shadow) or color 3 (square with shadow). This is what gives the floor the proper shadowing on the squares! Simple, but effective.

Actually, in true ray-tracing, we would follow the ray until it hit the floor, then determine whether or not that pixel was in the shadow of an object, but that takes a great deal of extra time. This simple pre-processing makes the operation proceed much faster. Using the existing routines in this program, however, it would not be too difficult to convince the program to do true shadow-checking, where a shadow could fall partially onto the floor and partially onto a wall, bending properly around the corner! I leave this as an exercise to you.

Once the floor bitmap is created, the program begins the ray-tracing process by calling the `genframe()` function. The primary ray-tracing routine, `genframe()` calls the `trace()` function for each pixel on the screen, causing a ray to be shot through that pixel and into the room. The `trace()` function returns the color of the bitmap (walls, ceiling or floor) that was hit. The `boucnt` variable holds the number of times the ray bounced off an object, and the `genframe()` routine then calls `myplot()` to plot the pixel's color after being dimmed by the number present in `boucnt`.

The `trace()` routine is the code that actually takes care of the ray-tracing itself. The movement vector for the ray is calculated from the viewpoint to the screen pixel coordinates, stored in the `xi`, `yi` and `zi` increment variables, and is changed to a step value that moves the ray through the room as quickly as possible without missing the smallest sphere in the room. This step value is set in the `bigincs()` function.

Once the ray's movement vector is calculated, it is followed around the room until it either hits a wall, the ceiling or floor, or enters the bounding box of a sphere (the bounding box limits of each sphere are stored in the `minx`, `maxx`, `miny`, `maxy`, `minz` and `maxz` arrays).

Ray-Trace...

- Allow other types of objects in the scene, such as cubes or free-form 3-D models from programs such as CAD-3D.
 - Perform true light-source modeling with shadows. This would take more time, but is perfectly feasible on the ST.
- With this technique, your image could have realistic shadows (from single or multiple light sources). When the ray hits a wall or the floor, cast a new ray from that point to an imaginary light source. If the ray hits an object before it hits the light source, the point is in shadow.

As you can see, this program could be the starting point for a whole new branch of exciting graphics for the ST. I hope you enjoy working with the program and generating high-quality images. The ST is a truly worthy graphics machine—let's see what we can make it do!
 (Editor's Note: As with the FujiBank! program in issue #2 of START, we are very interested in seeing what additions our readers can dream up. If you make an interesting modification to the Tracer program, send it to us at the address in the front of the magazine. We may run it in the magazine and pay you for it, to boot.)

REFERENCE:

BOOKS

Procedural Elements for Computer Graphics, by David F. Rogers, McGraw Hill, pp. 360-381

An Improved Illumination Model for Shaded Display, by Turner Whitted, Communications of the ACM, June 1980, pp. 343-344

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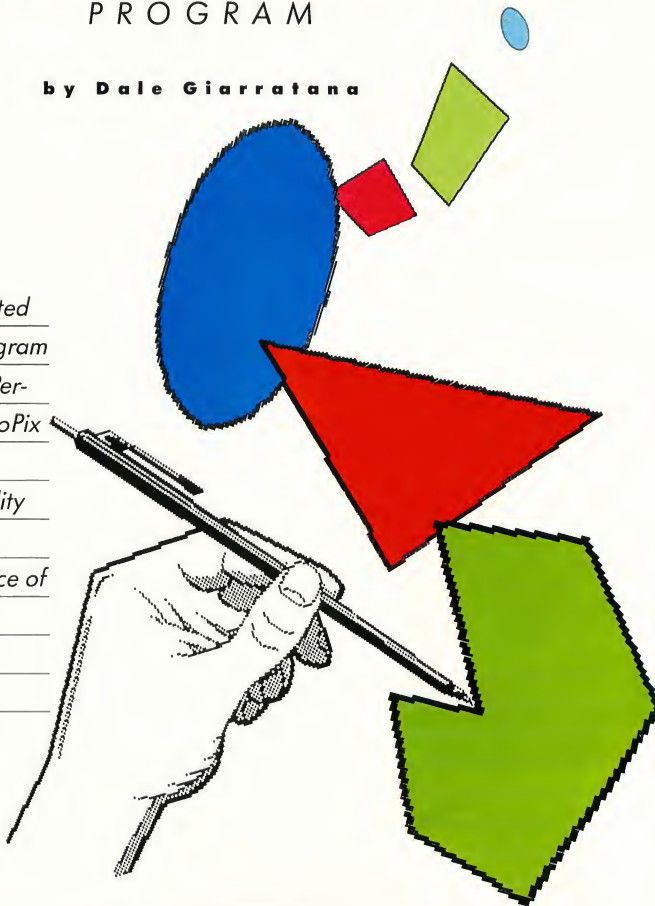
MACROPIX

A PERSONAL PASCAL DRAWING PROGRAM

by Dale Giarratana

An object-oriented GEM graphics program written entirely in Personal Pascal, MacroPix also serves as a graphics macro utility for animated title screens and a source of memory-efficient graphics for your programs.

 Folder MACROPIX.ST on your START disk



I can't draw a straight line; for that matter, I have a pretty hard time with circles, squares and squiggles. So, I turn to computers for help. I had wanted to try my hand at programming in Personal Pascal, and a drawing program seemed the ideal choice. It would give me an opportunity to learn many of the graphic-oriented GEM routines which were why I bought an Atari ST in the first place.

Basically, there are two ways to store computer graphics information, whether on disk or in memory: direct screen memory storage, or object information storage. The first method is used by paint programs like DEGAS or NEOchrome which save the actual screen memory—an array of the pixels. This results in a disk file at least 32K in size. Object information storage is more complex and varied. There are several methods, but the principle is the same: object-oriented “draw” programs—such as EasyDraw or CAD 3-D—“record” the coordinate and vector data along with the commands used to create the drawings. The commands are “played back” using the saved data, and the complete picture is redrawn. For example, a line can be expressed by two points and the command to draw a line between those two points. Unlike direct screen-memory picture files which are always the same size, object information files vary in size, depending on the complexity of the picture. Usually they are quite a bit smaller.

MacroPix is an object-oriented graphics program. Each time you execute a graphics command—whether to draw a circle or to fill a box—that command's special number code is added to an array along with any necessary data values (such as X and Y position coordinates).

PROS AND CONS

The picture files created by MacroPix vary in size depending upon the number of graphics moves made, but they will usually add up to no more than

several kilobytes, as compared to the 32K of most paint program files. The small file sizes offer a viable method to include several graphic screens in an application with little memory overhead. Also, if you're thinking of writing a graphics/text adventure, which requires many pictures in one program, this is the technique for you. Sierra Online has been using it for years.

Unfortunately, whereas paint pictures slap themselves quickly to the screen at the speed of a memory move,

If you're thinking of writing a graphics/text adventure, this is the technique for you.

MacroPix has to go through and redraw each command. Depending upon the complexity of the picture, this will usually take more time than a paint file. The screen redraw, however, can be used to your advantage: You can take the redraw into account and create simple animations. Although paint program boo-boos may be painted over leaving no one the wiser, draw over a mistake in MacroPix and it will briefly rear its ugly head during each redraw. But take heart. I have added an editing feature to MacroPix to take care of just this problem.

HOW TO USE MACROPIX

Okay, spread out the magazine and stick a paperclip at this place. We're going to do some drawing. Boot your START disk, click open the folder MACROPIX.ST, unsqueeze and run MACROPIX.PQG. (See the Disk Instructions

page for information on unsqueezing—decompressing—the MacroPix program.) MacroPix is very easy to use. You could probably figure it out without reading a bit of this, but it's always nice to have some documentation.

You can run MacroPix from any resolution. For our purposes, we'll describe an operation in low resolution because we like to play with all the colors. When you click and run MacroPix, you will first see a title screen telling you to press any key. So—press any key. (I'm partial to [K], some people prefer [I].)

You are now in the familiar GEM environment with a menu bar across the top of your screen revealing the choices: Desk, MODES, SPECIAL, and POINTER. Desk contains any desk accessories you may have loaded plus a title box under the heading, MacroPix. Run your mouse cursor along the other menu bars and check out the options. Instead of listing them all in order, let's just draw something and take advantage of each option as we need it.

When the program starts, you're all set to plot points. Move your mouse cursor around on the screen and click the dots button a few times. Little black dots will appear here and there. (In monochrome these dots may require a magnifying glass to see, but rest assured, they do exist. Also, those people with monochrome monitors should ignore our upcoming references to color. No matter what color we mention in this article, you will see either black or white. You're probably used to this by now.) Now, move up to the drop-down MODES menu and—yup, you can tell by the check mark that you are in POINTS mode. This is the default mode of MacroPix, along with the default color of black. Notice the number on the right of the menu bar. This index shows you how many graphics instructions you have stored so far. Since you are in POINTS mode, the number will ▶

remember?). You may also save and load color palettes by using COLOR FILES. Apart from the colors changing, loading color files will not affect the drawing in memory. Both of these options use the familiar GEM file selector box.

If you don't now have a whole bunch of patterns and drawings on the screen, go out and scribble some, then come back here when you're through. Finished? Okay, within the SPECIAL menu, click on REDRAW. REDRAW clears the screen and recreates your drawing from scratch. Now, click on EDIT, choose ALTER DELAY, press I(ESC), enter an amount like 20, and press R(RETURNS). Click on REDRAW again to see the difference. This delay time is saved with your picture.

Click on EDIT and choose EDIT MOVES. This will place you in a special screen showing just the first drawing move. Each click of the left button executes a move until you have marched entirely through the drawing. At any point, you may press I(ESC) and be given the choice to EXIT, DELETE (that move), or CONT(inue) stepping through the moves. Should you choose to DELETE a move, you won't notice it is missing until you REDRAW the screen. (Deleting moves can cause some pretty strange things. If, say, a box was originally drawn and later filled, and you go back and delete the BOX move, when the FILL move comes along, much of the screen may be flooded.)

If you just want to delete a portion of your drawing, but don't want to do it one step at a time, choose EDIT then MULTIPLE DELETES. This will prompt you for the number of moves you wish to delete, in descending order (from most recent to first).

Looking again within SPECIAL, DELETE MOVE will perform the same function as pressing the I(DELETE) key. NULL MOVE is a feature primarily added for those interested in creating sim-

MODE	NUMBER	COMMAND	DATA VALUES
	1	plot point	Color, X, Y
	2	line	Line type, Color, X, Y, X2, Y2
	3	outlined circle	Null, Line type, Color, X center, Y center, X radius, Y radius
	4	outlined box	Null, Line type, Color, X upper left, Y upper left, Width, Height
	5	filled circle	Fill type, Line type, Color, X center, Y center, X radius, Y radius
	6	filled box	Fill type, Line type, Color, X upper left, Y upper left, Width, Height
	7	triangle	X apex, Y apex, X corner, Y corner, Line type
	8	area fill	X, Y, Color, Fill type
	9	3D box	X upper left, Y upper left, Width, Height, X2 upper left, Y2 upper left, Color, Line type
	10	3D triangle	X apex, Y apex, X corner, Y corner, X2 apex, Y2 apex, Height, Width, Upside-down triangle flag, X lower right corner, Line type, Color.
	11	add 3 to DP	
	12	add 6 to DP	
	13	add 7 to DP	
	14	add 7 to DP	
	15	add 7 to DP	
	16	add 7 to DP	
	17	add 6 to DP	
	18	add 4 to DP	
	19	add 8 to DP	
	20	add 12 to DP	

FIGURE 1

ple animations. At some point, you may want nothing to happen. A click on NULL MOVE will increment the move counter and delay without drawing anything.

I think we've covered all functions. Let's try a simple animation. Click on CLEAR to begin fresh. Make sure you're using solid lines and you have a nice variety of colors in your palette. Choose a blue from the COLOR screen. Go to the FILL PATTERNS menu and choose the pattern of quarter-inch cross grids. Now, activate AUTO-FILL, select BOX and draw a big, blue, grid-filled box that takes up most of the screen.

Change to a red color. Turn off AUTO-FILL (by clicking again on it). Choose the solid pattern from the FILL PATTERNS menu. Click on FILL AREA. Now, fill each square in the blue grid with solid red in some pattern. Spell your name, or just snake around. Remember, when you play this back, the fills will appear in the same order, one at a time.

Now that you have an interesting pattern of dots, change colors again—maybe green. Select CIRCLE, find a spot to start it, and draw a small (quarter-inch, or so) circle. Click at the center of this circle and draw one slightly larger. Repeat this until you have a huge, screen-filling circle. All right, we're almost ready to roll the projector, but, first, let's get rid of the grid.

From the COLOR screen, select the blue in which your grid was drawn and change the RED, GREEN, and BLUE values to match the background (probably 0,0,0 for white). Now, go back to the main screen and choose REDRAW. If the whole thing is too fast, choose ALTER DELAY from EDIT and try a higher number.

When working with animation, keep in mind that some drawing functions work faster than others. Experiment until you get the results you want. Programmers may want to use their drawings in their own program. This can, of course, be done. (Non-programming ar-▶

MACROPIX...

tists can drop off here. Beyond this point speak we computerize.)

FILE STRUCTURE

MacroPix stores picture files on disk in much the same manner as it does in memory; as a series of instructions. All the variables stored on the disk are in



MacroPix editing screen.

integer form (two bytes). The variables are stored as follows:

TIME—variable used in the delay procedure. (0 = no delay).

MP—Total number of moves executed (number of values in the MODE array).

DP—Total number of integers saved as data for the drawing moves (number of values in the DATA array).

COLORS—red, green, and blue values for the 16 colors. 48 integers in all.

MODE—integers put in the mode array. Amount defined by MP

DATA—integers put in the data array. Amount defined by DP.

The MODE array holds a sequential list of the commands executed. Each command is stored as an integer value. The DATA array contains information needed by the commands in the MODE array, such as the X and Y positions, fill color and line type. (See Figure 1.) Note that there is not a one-to-one correspondence between the elements in the two arrays. In fact, the DATA array can be six to seven times larger than the MODE array because all draw commands require at least three integers; some commands even require more. For example, a point needs only three

values, whereas a 3D triangle can't live without 12. In many cases, I did not use the most efficient method of storing data, opting for less complicated code. The table in Figure 1 documents the MODE and DATA contents. The last ten commands (11-20) are used by the edit routine when you delete moves from within a sequence. Rather than actually restructuring the entire array for a delete (which would have been tricky), the program merely adds ten to the mode value, creating a command which instructs the redraw routine to skip over those DATA values. A delete from the end of a sequence actually removes the elements from the arrays.

Drawing the picture using all this data is fairly straightforward. First, the screen is cleared, then a command is pulled from the MODE array. Depending on the instruction (for example, draw circle), a corresponding routine is executed. This routine uses information from the DATA array to draw a line, fill a circle, or whatever the particular command happened to be. The pointers to the two arrays are incremented, and the whole procedure is repeated until all the elements have been drawn.

All this may be confusing right now, but if you know anything about Pascal you could probably look through the

source code to figure out how to use the picture files.

MISCELLANEOUS

MacroPix is a very long program, thus to go over every step would take far too many pages. Instead, I will try to cover



the more important procedures and techniques that I used. Many of the tricks demonstrated by MacroPix were realized only after long telephone calls to OSS, the makers of Personal Pascal. The technical support staff at OSS was invaluable during this program development and I must commend them for a job well-done.

Personal Pascal has most of the VDI routines already built into the language but not all. Calls for seed fills or other not-so-simple tasks were left out. Many of these can be accessed by calling the VDI routines directly. To make VDI calls copy the procedure `VDI_CALL`, the variables `CONTROL`, `INT_INA`, `INT_OUTA`, `PTS_INA`, and `PTS_OUTA`, and all the `TYPE` declarations from the MacroPix source code. To use this call you must first define the integers-in under the array `INT_INA` and points-in under the array `PTS_INA` (such as `INT_INA[0]:=1`). You then can make the VDI call as follows: `VDI_CALL(command #, sub command #, number of integers in, number of points in, CONTROL, INT_INA, INT_OUTA, PTS_INA, PTS_OUTA, true or false) ;`

The last declaration for true or false depends on whether you want translate

**Once you
choose AUTO-FILL,
certain drawing
modes automatically
fill in whatever
pattern you're
chosen.**

the points in (PTS_INA) and points out (PTS_OUTA) relative to the current origin (this declaration is usually false). If the call involves the returning of any parameters they can be found in the arrays PTS_OUTA and INT_OUTA. You will be able to find some examples of the call in the program. If you need more information on VDI calls you can send a self-addressed stamped envelope to OSS requesting information on VDI and AES calls.

The Personal Pascal documentation on using IO_CHECK and IO_RESULT is a bit confusing. I found that if you don't declare these commands as global variables (after the type declarations) you will get a compiler error. To

You can run MacroPix from any resolution.

declare these as global you must add the following lines to your global variable declarations.

```
PROCEDURE IO_
CHECK(FLAG:BOOLEAN) ;
EXTERNAL ;
FUNCTION IO_
RESULT :INTEGER ;
EXTERNAL ;
```

You can now use the commands as explained in the manual.

The simplest way to write text to the screen is the DRAW_STRING command provided with Personal Pascal. Unfortunately, this only works with strings. But what if you wanted to output an integer or any other variable type besides a string to the screen? The WRITE command is a partial solution, but the text can show up just about anywhere on the screen. To correct this problem, copy the procedure GOTOXY into your own code. To move the cursor

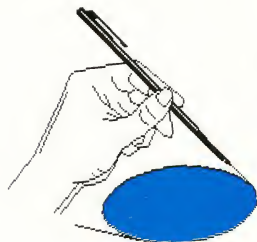
make the call: GOTOXY (*x-position*, *y-position*), where *x-position* and *y positions* are the coordinates in character positions. The procedure then adds 32 to the x and y variables and makes the call WRITE(CHR(27),CHR(89),CHR(Y),CHR(X)) ; to move the cursor to the x and y positions.

Dynamic variables offer you a powerful, albeit confusing, way to move large blocks of memory for tasks such as saving the screen. MacroPix utilizes dynamic variables when it switches to and from the color selection and fill selection screens. This technique also provides a simple way to redraw the screen after a dialog box. To switch screens like this you must first turn off the pointer range checking ({\$p-}). Then, you must then declare two type constants as follows. The first one allocates enough array space to hold entire screen and the second sets up a pointer into this array:

```
SCREEN = PACKED ARRAY
[0..31999] OF BYTE ;
SPTR = ^SCREEN ;
```

After declaring the type constants you must declare two pointers under the global variable table as follows:

```
SCR1,SCR2 :SPTR ;
```



To get the address for the physical base of the graphic screen you make an xbios(2) call. To do this add the following lines:

```
FUNCTION PHYBASE :SPTR ;
XBIO5(2) ;
```

You then set the pointer SCR1 equal to PHYBASE (SCR1:=PHYBASE ;). Now you may save the screen in memory by the following:

```
NEW(SCR2) ;
SCR2^ := SCR1^ ;
```

To restore the screen from memory do the following:

```
SCR1^ := SCR2^ ;
DISPOSE(SCR2) ;
```

(Note: you must make the call DISPOSE(SCR2) ; before you can do the save screen commands again.)

This is probably the shortest and easiest way to save screens in memory. For more information on this, contact OSS.

FOR YOUR OWN USE

If you are programming in Personal Pascal, you can easily use the MacroPix pictures in your own program by copying all procedures in the MACROPIX.PAS listing that are labeled with an asterisk (*). You must then copy the MACROPIX.PAS global variable table to the beginning of your code. To use the loading procedure, define the string FNAME to the file name of the picture and call the procedures LOADSCR to load the picture into memory, then REDRAW to redraw the screen in memory. (Note: You must delete some of the lines in the procedure REDRAW as commented in the source code). ■

REFERENCE

- *Personal Pascal*
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CIRCLE 174 ON READER SERVICE CARD



JAMES ENDICOTT

A surprising thing happened in 1982. Several of the leading manufacturers of electronic musical instruments, normally fierce competitors, decided to sit down together and develop a means whereby their instruments could communicate with each other. They wanted to set things up so that a synthesizer from company A could drive a drum machine from company B or even a synthesizer from company C.

Why? Well, for several reasons. It was, and is, very useful to have more than one synth playing the same part. You can often get considerably more interesting sounds using two different in-

struments than you could with any one instrument, a fact well known to classical composers. However, it's difficult for a single player to play several instruments at the same time, and rock bands generally don't carry more than one keyboard player.

Hardware devices called *sequencers* (actually dedicated computers; see later in this article for a discussion of software sequencers) were coming into use. The problem was that a sequencer put out by one company would not work with a synth or drum machine put out by another company. Sound familiar?

Synchronization was also an issue. Drum machines were becoming popu-

lar, and many people wanted an easy way to synchronize their keyboards to their drum machines and vice-versa.

So, in a move that should be an example to the computer industry, these brave souls carved out a hardware and software standard that defines exactly how electronic musical instruments should communicate. They named their invention Musical Instrument Digital Interface, or MIDI.

Communication between musical instruments and personal computers was not the primary concern of the MIDI developers, but since in reality almost all digital synths, drum machines, and

MIDI...

Connecting your ST to a MIDI equipped synthesizer.

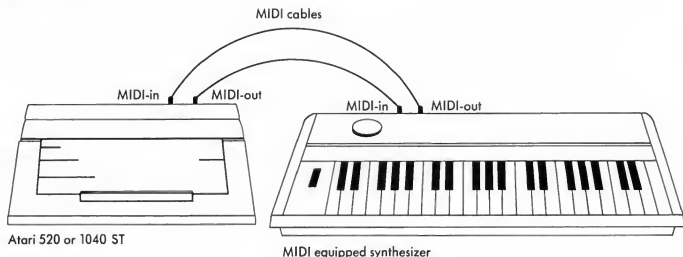


FIGURE 1

sequencers are dedicated computers, it was natural that the MIDI standard turned out to work so well with computers.

HOW MIDI WORKS

Let's take a look at how MIDI actually works. Suppose you have a MIDI-equipped synth and have attached a MIDI cable from the MIDI-out port of your synth to the MIDI-in port of your ST (see Figure 1). Every time you press down a key on your synth it will send a message over the MIDI cable to the ST telling it a key was pressed down ("note on event" in MIDI jargon), which key it was, and how hard you pressed the key. (The latter is particularly useful with "velocity sensitive" keyboards, such as the Yamaha DX-7.)

A different signal is sent when you release that key. This signal will be a "note off event" (logical enough), and will also specify which key was involved and, on some synthesizers, will tell how quickly the key was released.

You can see that if your computer is keeping track of these signals, and the amount of time between them, it now has a record of which notes you have played and how long they were. The software doing this is called a sequencer; I'll discuss it in some detail in

the section on software.

Now, if you have a MIDI cable running from the MIDI-out port of your ST to the MIDI-in port of your synth, and the proper software, your computer can make your synth play back the notes you played on the synth in the first place. All the software has to do is send those same "note on" and "note off" signals it saved, making sure it waits the appropriate amounts of time between notes.

Since MIDI sequencers function, in many ways, like tape recorders, there are some persistent misconceptions. MIDI sequencers do not "record" music like a tape recorder. They record a series, or sequence, of events: Note on events, note off events, pitch-bend events, and so on, that are produced by an electronic musical instrument equipped with the appropriate MIDI hardware and internal software. A MIDI sequencer cannot record your voice, at least unless you can find a way to equip your vocal chords with a MIDI-out port.

The wonders of MIDI come from the fact that the list of events you store in your computer can be treated as data and manipulated in many ways, just as a word processor allows you to manipu-

late your words much more easily than you can on a typewriter.

The MIDI standard provides for 16 channels of communication. This means your ST could send a different set of notes (in the form of note on and note off events) to sixteen different synthesizers, or even to sixteen different sets of synths, with all of the synths in each group set to the same channel. In reality, such a system is rare, mostly because of the expense, and MIDI does run into some trouble when it is pushed that hard, but the capability is there.

NON-PROFESSIONAL USES OF MIDI

MIDI was designed for professional electronic musicians, and has become extraordinarily popular with them. MIDI is such a useful tool, however, that it was only a matter of time before it came into general use. With synthesizers dropping in price to the point that you can buy a very useful instrument for \$300 or so, a lot of people who do not make their living by music are buying instruments and MIDI software.

An example of non-professional MIDI software is Activision's popular Music Studio. With the mouse, you en-

Wiring diagram for MIDI-thru adaptor.

Male 5-pin DIN connector to be plugged into the ST MIDI-out port after the adaptor is complete.

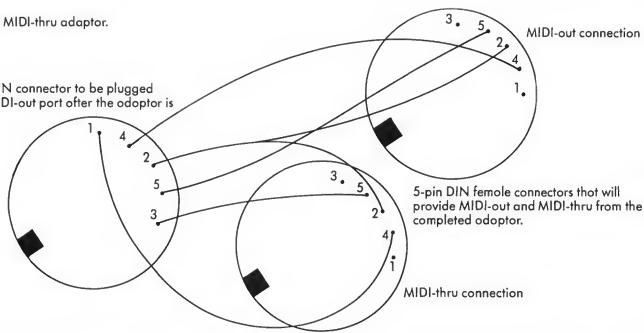


FIGURE 2

ter a series of notes on a staff and can play them back either through the ST's sound chip or through any MIDI-equipped synth. The program is too limited for professional use but is highly entertaining and educational. However, it has quite a strong following from music hobbyists, resulting in hundreds of song files available from user's groups and bulletin board systems such as Compuserve and Genie. It doesn't really fit into any category—it's not a sequencer since it doesn't record notes in real-time from the synth, but it's fun!

Another clever use of MIDI comes from QRS, the people who sell mechanical piano rolls. They have converted many of their piano rolls to MIDI data and sell a program called MIDI Magic that plays them back while displaying a moving piano roll on the screen. I'm biased about this program, since I wrote the Atari ST version, but I enjoy listening to George Gershwin playing my Casio CZ-101 while I watch his piano technique on my computer screen.

There is a huge potential for MIDI as an educational tool, but it's still largely undeveloped. (Are you listening, software companies?) MIDI also takes away some of the need for years of intensive training in the physical act of playing,

considered "paying your dues" by performing musicians. The transition from amateur to professional may well become easier because of MIDI. The jury is still out on whether or not this is a good thing, but technology evolves whether we like it or not, and music is no exception.

MIDI SOFTWARE

The most important kind of MIDI software is the sequencer. In its simplest form, a sequencer stores the sequence of events (or notes) coming in over MIDI so they can be played back either through the same synth or through any other MIDI equipped synthesizer.

Note that last bit. Once you've stored the sequence, you can play it back over any instrument or instruments you want, as long as the receiving instrument is properly equipped. This means you can prepare a piece of music at home on a relatively inexpensive keyboard, then go into the recording studio with the best equipment you can rent or borrow for the actual session.

Even more significant is the manipulation you can do on the music once it's stored. The best sequencers allow you to edit each note of your music much like a document in a word processor. Missed a note? Take it out and put in

the right one!

In addition, with a good sequencer, you can transpose the notes, "quantize" them (take out certain kinds of rhythmic imperfections), add dynamic changes (changes in the loudness), set up repeating patterns, and overdub. You could also record one line, or track, at a time. Many sequencers actually allow you to exceed your synth's capabilities several times over.


Although sequencers were developed for professional musicians, they can be just as useful to amateurs. A good professional sequencer, however, can cost several hundred dollars. Several companies are selling "consumer" sequencers for under \$100; but as with all software purchases, make sure what you're getting. Some of the inexpensive packages offer little or no editing. Those of us who are not expert keyboard players need more editing facilities than, say, Jan Hammer or Stevie Wonder. Unless your fingers never miss when they tickle the ivories, look for a sequencer that allows you to edit individual notes. (Editor's note: *The first issue of START included a simple sequencer written by none other than Mr. Jeffries.*)

There are some other, very useful, ▶

MIDI...

kinds of MIDI software, such as patch editors and librarians. The sounds produced by a synthesizer are determined by the "patch" the synth is set to (the term is a holdover from the 1960's when synthesizers consisted of modules connected with patch wires; you set the sound by plugging and unplugging wires). Most synths will hold only a limited number of patches, and patch storage with plug-in cartridges gets expensive very quickly when the cartridges for some leading synths cost \$75 or so apiece.

Floppy disks, however, are pretty cheap, and it didn't take long for people to start writing programs to get the patches from the synth and store them on disk. Programs that do this are called patch librarians.

 Originally, patch librarians just worked with a single kind of synthesizer, so, if you had 4 different synths you had to buy 4 different patch librarians. That got old quickly, especially since the synthesizer manufacturers kept coming out with new machines. So, somebody got the bright idea of writing universal patch librarians that could handle patch information from a variety of synths. This gets difficult also, since every synth has a different way of storing its patch data and the software companies have to keep updating their software to match new instruments, but from the user's point of view it's a vast improvement.

Patch editors are often confused with patch librarians, but, although there is some overlap they really serve quite different functions. Most synths are very complex machines, and the process of setting up a really interesting sound on them can be extremely difficult and time consuming, since they only provide buttons (and maybe a slider or two) for input and a tiny LED display to let you know what's going on.

A computer, with its full screen display, keyboard, and, in the case of the

ST, a mouse, is a much better environment for editing the sounds or patches to be used by the synth. A program allowing you to edit patches is called, reasonably enough, a patch editor. Some patch editors even employ artificial intelligence principles, facilitating the creation of new sounds.

Patch editors normally include patch librarian functions. They only function with a single synthesizer, however, because the inner workings of each synth are so different it is not really possible to build an editor that will deal with all of them. Some companies are working on patch editors that can be co-resident in memory and work in conjunction with a sequencer, letting you have your cake and eat it too. This is only possible with computers like the ST, providing large amounts of memory at reasonable prices.

MIDI
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some of the need
for years of
intensive training
in the physical act
of playing.

There are several other types of MIDI software. There are filters that change the data coming from one synthesizer on its way to another. There are composition programs that generate pieces of a composition according to rules you set out. There are score printing programs that, while not MIDI-based, can read a file from a MIDI sequencer and turn it into printed music.

I suspect we've only seen the tip of

the iceberg so far. MIDI has so much to offer; over the next few years I expect to see software which will allow us to do things we simply couldn't have done without it.

MIDI AND THE ST

The MIDI interface was designed to be inexpensive and easy to implement; still, it was a pleasant surprise when Atari announced they were going to include it in the ST. With other computers you had to spend between \$50 and \$450 to add a MIDI interface.

Atari did a reasonably good job of it, too. They provide the standard 5-pin DIN connectors for MIDI-in and MIDI-out, attached to the internal circuitry of your ST through devices called optoisolators which prevent certain kinds of noise which occurs because of connections between your computer and your synth.

MIDI CABLES

Unfortunately, Atari decided to get fancy and included a feature called MIDI-thru without spending the money to add another 5-pin DIN plug for it. A MIDI-thru port simply copies exactly what is coming in the MIDI-in port, and sends it through unaltered. So, if you are playing on a MIDI controller keyboard that doesn't produce any sound you can hook up a synth which will produce a sound to the MIDI-thru and hear what you are playing into the sequencer.

According to the MIDI standard, only three of the five pins of the MIDI-out port should be used. Atari connected the two signal lines (the third line is used for shield/ground) from the MIDI-in port to the two unused lines on the MIDI-out port. The idea was to provide MIDI-thru, although such a non-standard implementation should have been called something else to avoid confusion in the first place.

Atari's version of MIDI-thru isn't much use without some kind of adaptor that will split the signal into a proper MIDI-out and MIDI-thru, so I

have provided directions to build this extremely simple adaptor. Limited usefulness, however, is not the biggest problem with the "MIDI-thru" on your ST.

Not long ago I wrote a commercially-available patch editor for the Casio CZ-101, 1000, 3000, and 5000. It was quite popular, but customers called us, saying it caused their synthesizers to lock up or exhibit other bizarre behavior. Long discussions with Casio, many experiments, and considerable hair-tearing were to no avail. The worst thing was that we could not recreate the problems on our equipment.

Finally, one of the customers having this difficulty took a look at the cable he was using. Much to his (and our) surprise, it had the two pins which should be unused wired to the two signal pins. Since the unused pins on the Atari MIDI-out were sending a copy of the MIDI-in signal, the handshaking required to exchange patches with the synths was impossible. In fact, the effect was so confusing to the CZ it locked up.

Both Atari and the company making the cables had deviated from the standard, although with non-malevolent intentions. Both, however, assumed that no one else would deviate from the standard. Unfortunately, they were incorrect in that assumption.

There are two solutions to this problem. One is to cut the wires connected to pins 1 and 3 (the two outermost pins) on the cable you connect to the MIDI-out port on your ST. The second is to run down to your local electronic parts house, pick up a few inexpensive parts, and put together an adaptor that will upgrade your ST to the proper MIDI standard.

THE ADAPTOR

MIDI-thru provides a way to play one synth from another without disconnecting your ST. Let's say you have a synth with a keyboard and also one without—maybe one of the popular

Yamaha TX7 modules, or the new FB-01. You've laid down some hot rhythm section parts using your favorite sequencer software and your keyboard connected, via MIDI cables, to your ST.

You want to try out some lead lines, but you think they'll sound better on your synth with no keyboard. With MIDI-thru, all you have to do is connect a MIDI cable from the MIDI-thru port

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on your ST to your keyboard-less synth, set the sequencer to playback, and play your lead lines on your CZ. The signal will go straight from the keyboard to the keyboard-less synth while your rhythm parts are being played back on your keyboard.

Of course you can accomplish the same things with the right combinations of cables and splitter boxes, but MIDI-thru is a convenient and inexpensive way to handle quite a number of situations. With this adaptor, you can add something new to your MIDI bag of tricks.

This is a very simple project, but if you have no experience with hardware you will need more instructions than I have space to provide here. There are a number of books and magazines covering the basics of putting together circuits; if you want one of these adaptors and don't want to go to the trouble to

make it yourself, I'm sure you can find a TV, stereo, or musical instrument service center to make it for you at a reasonable cost.

You'll need very few parts to make this adaptor: one male 5-pin DIN connector, two female 5-pin DIN connectors, and some short connecting wires. It would probably be best if you used shielded cable for connections, but I used plain wire and haven't had any trouble. The secret is to keep the wires short to minimize the possibility of interference. If you can find them, get DIN connectors with solder lugs and your work will be easier.

You should find a little number near the solder connection for each pin on your sockets. That number is the pin number and corresponds to the numbers you will see in Figure 2. Make sure you connect the correct wire to the correct pin and there are no solder connections or pieces of wire between the pins.

You need to solder six wires to the 5-pin male DIN connector—the middle pin (#2) needs two wires. If you are going to be fancy and use shielded cable, the shields for the two cable sections should both be attached to this pin in place of two wires.

After that it's just a matter of soldering the correct wire to the correct pin on the female 5-pin DIN sockets. Pin 2 (ground) on the male socket has to be connected to pin 2 on both of the female sockets, either through a short length of wire or through the shield on your shielded cable if you are using shielded cable. Pins 1 and 3 of the male socket have to be connected to pins 4 and 5 of one of the female sockets (this will be your MIDI-thru port), and pins 4 and 5 from the male socket have to be connected to pins 4 and 5 of the other female socket (for normal MIDI-out operation).

Make sure you get all the wires connected correctly, and make sure no ▶

MIDI...

Note	Octave	MIDI#
c	0	0
c#	0	1
d	0	2
d#	0	3
e	0	4
f	0	5
f#	0	6
g	0	7
g#	0	8
a	0	9
a#	0	10
b	0	11
c	1	12
c#	1	13
d	1	14
d#	1	15
e	1	16
f	1	17
f#	1	18
g	1	19
g#	1	20
a	1	21
a#	1	22
b	1	23
c	2	24
c#	2	25
d	2	26
d#	2	27
e	2	28
f	2	29
f#	2	30
g	2	31
g#	2	32
a	2	33
a#	2	34
b	2	35
c	3	36
c#	3	37
d	3	38
d#	3	39
e	3	40
f	3	41
f#	3	42
g	3	43

Note	Octave	MIDI#
g#	3	44
a	3	45
a#	3	46
b	3	47
c	4	48
c#	4	49
d	4	50
d#	4	51
e	4	52
f	4	53
f#	4	54
g	4	55
g#	4	56
a	4	57
a#	4	58
b	4	59
c	5	60
c#	5	61
d	5	62
d#	5	63
e	5	64
f	5	65
f#	5	66
g	5	67
g#	5	68
a	5	69
a#	5	70
b	5	71
c	6	72
c#	6	73
d	6	74
d#	6	75
e	6	76
f	6	77
f#	6	78
g	6	79
g#	6	80
a	6	81
a#	6	82
b	6	83
c	7	84
c#	7	85
d	7	86
d#	7	87

Note	Octave	MIDI#
e	7	88
f	7	89
f#	7	90
g	7	91
g#	7	92
a	7	93
a#	7	94
b	7	95
c	8	96
c#	8	97
d	8	99
d#	8	99
e	8	100
f	8	101
f#	8	102
g	8	103
g#	8	104
a	8	105
a#	8	106
b	8	107
c	9	108
c#	9	109
d	9	110
d#	9	111
e	9	112
f	9	113
f#	9	114
g	9	115
g#	9	116
a	9	117
a#	9	118
b	9	119
c	10	120
c#	10	121
d	10	122
d#	10	123
e	10	124
f	10	125
f#	10	126
g	10	127

Highest allowable MIDI note number.

* middle "C" on the piano.

TABLE 1

wires can short out against each other at the 5-pin DIN connectors. I tend to use pieces of electrical tape for extra insulation if it looks as if anything might ever be a problem: Think about what a few years of abuse might do to loosen things up.

Now, put the sockets themselves back together, and plug the male socket into the MIDI out port on your ST. The female socket connected to pins 1 and 3 of the male socket should now function as a proper MIDI-thru port, and the female socket wired to pins 4 and 5 of the male socket is now a correct MIDI-

out port. Be sure to label the two female sockets so you know which is which without tearing the whole thing apart!

With the addition of a MIDI-thru adaptor, the ST's MIDI hardware is complete. A built-in external clock synch would be nice, but we can't have everything, and that's not actually a part of the MIDI specification.

WRITING MIDI SOFTWARE ON THE ST

The ST is equally well-equipped in the area of built-in software. TOS provides some functions that work very well for

sending and receiving MIDI data between the ST and another MIDI-equipped instrument. Usually a programmer has to write some very knotty and time-critical code to a device called a UART to send or receive MIDI; Atari has taken care of that work for us.

Since C is the language of choice for most ST programmers (and the editors will probably be annoyed if this article gets much longer), I'm only going to provide information on accessing the MIDI ports from C. If you are programming in assembly, you'll have to disassemble the bindings from a C library

(something you're probably quite used to by now); if you are programming in another language, you will have to check your documentation for access to MIDI.

To send some information from your MIDI-out port, set up an array or string of bytes with the information like this:

```
static char midiinfo[] = {fill in your
MIDI data here};
/*80 byte maximum for
each call to Midiw*/
```

Count the number of bytes you plan to send, and then send it like this:

```
Midiw(count-1,midiinfo);
```

To get a byte of information from the MIDI port, use the BIOS functions Bconstat() and Bconin() like this:

```
unsigned char midibyte;
if(Bconstat(3) == -1)/ *3
tells the BIOS you are
looking for MIDI*/
midibyte = (unsigned
char)Bconin(3);
```

Note that some C compilers will do some very strange things with chars over 127 when you try to do comparisons and arithmetic with them. Many C compilers do not seem comfortable with the notion of an unsigned 8-bit number and will try to sign extend it when converting it to an int for arithmetic—thus making your 128 into a -128!

These examples are oversimplified and wouldn't be especially useful as they stand. However, those of you who have had the "pleasure" of writing MIDI software for other micros will appreciate how easy Atari has made these things on the ST.

The built-in MIDI handlers aren't perfect, and it is very common for music software companies to rewrite them for professional MIDI sequencers. For most purposes, though, they will be perfectly adequate.

MIDI CONTROL AND DATA FORMATS

Now that you know how to send MIDI data, you might want to know just what to send to get your synthesizer to play your favorite tune.

MIDI information is sent as a stream of 8-bit bytes. Two basic types are recognized: *control bytes* and *data bytes*. Control bytes include note-on events, note-off events, and several other kinds (see the accompanying chart, adapted from MIDI 1.0 Detailed Specification). Data bytes normally follow control bytes and give the receiver information, such as which note is supposed to be turned on and how loud it should be.

MIDI distinguishes between control and data bytes by setting the high bit of control bytes and clearing it on data bytes. In English, that means that data bytes are always less than 128, control bytes are always 128 or greater.

Take a look at the table of note values (Table 1). You can see each of the 127 different notes allowed by MIDI has a unique number, with middle "C" in the middle at 60. If you want to tell your synth to turn on a middle "C", then you would have to send it the note-on event control byte, which is 144 (if you are sending on channel 1, more about that next), then a 60, then a number between 0 and 127 that tells your synth how loud you want the note.

MIDI allows for 16 different data channels and four different modes for relating to those channels. The modes allow for a lot of flexibility, but in the interest of saving space I'll leave their details as an exercise for you readers.

Channels are a little simpler. Basically, a sequencer can use the 16 channels to send 16 different sets of information to 16 different synths or groups of synths, while each group ignores the info sent to the other groups. Since music rarely needs more than 16 completely different parts going at the same

time (remember that each of the 16 parts can include multiple voices up to the limits of the synths involved), you can get a heck of a noise going if you use everything MIDI has to offer.

In practical terms 16 independent sets of voices will stretch the limits of

**Once you've
stored the sequence,
you can play it
back over any
instruments
you want.**

the MIDI data transmission rate (31,250 baud), not to mention the ears of the listeners. It is very common to use several channels simultaneously, however.

MIDI uses the low four bits of the control bytes to determine the channel to use for data transfer. This means if you want to tell the instruments set to channel 3 to turn on middle "C" you have to add 2 to the note-on event byte, making it 146 instead of 144. Note that MIDI counts from zero to fifteen instead of from one to sixteen, so you always have to add one less than the number of the channel you want to specify.

If you go back to the table of control bytes you will notice each type of control byte is assigned a number that is a multiple of 16. This means you can add anything up to 15 before getting to the next type of control byte. A note-on event can range from 144 for a note-on, channel 1, to 159 for a note-on, channel 16.

There are several types of control ▶

MIDI...

Number Code*	Description	Data byte 1	Data byte 2
\$80 (128 decimal)	Note-off event	note number (See Table 1 for note numbers.)	velocity
\$90 (144 decimal)	Note-on event	note number	velocity (Velocity usually deter- mines the loud- ness if your synth responds to different velocities.)
\$A0 (160 decimal)	Polyphonic key pressure	note number	pressure
\$B0 (176 decimal)	Control Change	control number	control value
\$C0 (192 decimal)	Program Change	program number (you can use this to change the patch your synth is playing on the fly—the program number is the patch number as your synth counts patches.)	none
\$D0 (208 decimal)	Channel Pressure	pressure value	none
\$E0 (224 decimal)	Pitch Bend event	value LSB (only low seven bits from each byte are used, zero pitch bend is sent as 0, 64.)	value MSB
\$F0 (240 decimal)	System Message	(number of data bytes varies, this is used for a variety of things including the system exclusive mode that your patch librarian uses to get patch information from your synth.)	

*channel number is added to the number code, see text for details.
Note that all data bytes use only the low seven bits.

TABLE 2 MIDI Control Bytes Status Bytes

bytes (the official MIDI spec calls them "status" bytes). You can change the mode, send messages that will be ignored by any but a specified synthesizer, send time pulses, and several other things.

Confused? Good, join everyone else who has dealt with MIDI. The point is, at least some things are very simple to do, and the others will become easier as you absorb more information. The MIDI

specification is a powerful tool and, while it has limitations, accomplishes a great deal. The more I work with MIDI the more respect I have for its originators.

If you want to do anything serious with MIDI, you will want more information. The best source, the horse's mouth so to speak, is the MIDI 1.0 specification. There is a 60-page booklet that includes the original spec and quite a bit

of explanatory material called the MIDI 1.0 Detailed Specification. This should be in the bookshelf of anyone trying to write MIDI software or even trying to understand the topic.

The price is \$35, which is outrageous for a 60-page booklet, but I assume that part of the price goes to pay for the phone line and staff that are maintained by the International MIDI Association. To get a copy, write the International MIDI Association, 11857 Hartsok St., North Hollywood, CA 91607 (818) 505-8964.

Several magazines offer strong coverage of MIDI. The most important is *Keyboard Magazine*, which publishes columns about MIDI constantly, often by the people who wrote the specification in the first place. Two other magazines to look for are *Keyboards*, *Computers*, and *Software and Electronic Musician*. There is also a BBS called PAN, which specializes in the arts. Their number is 800-336-0437.

If you can find a copy, I wrote a simple sequencer for the first issue of *START* (Summer 1986), illustrating the use of the MIDI ports. Also, I wrote an article appearing in the March, 1986 issue of *Antic Magazine* which discusses MIDI control and data bytes.

CONCLUSIONS

MIDI has become an indispensable tool for many performing musicians; for amateur musicians, MIDI can be both valuable and enjoyable. It offers the ability to do more with less, and that's one of the things we all hope to get from new microcomputing technology.

This article, long as it is, could only begin to talk about all of the ramifications of the MIDI standard. I hope your interest will be sparked and you will continue to investigate MIDI, since I think it will enhance your musical experience whether you are an amateur, a professional musician or a programmer. ■

A SAMPLING OF **MIDI SOFTWARE**

Compiled by Heidi Brumbaugh
Editorial Assistant

Activision

2350 Bayshore Parkway
Mountain View, CA 94039
(415) 960-0410

The Music Studio (\$59.95), designed by Audio Light, will let you create, edit and playback music from 15 different instruments.

CIRCLE 175 ON READER SERVICE CARD

Audio Light

146 Town Terrace
Los Gatos, CA 95030
(415) 344-4610

Compatible with their earlier Music Studio (see Activision, above), Audio Light plans to release the more powerful MIDI Studio in the first quarter of 1987 for under \$100.

CIRCLE 176 ON READER SERVICE CARD

Beam Team

6100 Adeline St.
Oakland, CA 94608
(415) 658-3208

This company's series of products includes a sequencer, **Transform Xtrack** (\$149.95), an editor/librarian, **Transform Xsyn** (\$99.95) and a GEM-based mouse editor, **Transform Xnotes** (\$199.95).

CIRCLE 177 ON READER SERVICE CARD

Dr. T's Music Software

66 Louise Rd.
Chestnut Hill, MA 02167
(617) 244-6954

Dr. T's large base of MIDI software includes their Keyboard Controlled Sequencer (\$195), the **MIDI Recording Studio** (\$39), and the **CZ Patch Librarian** (\$99).

CIRCLE 178 ON READER SERVICE CARD

Electronic Music Publishing House

2210 Wilshire Blvd., Suite 488
Santa Monica, CA 90403
(213) 455-2025

As well as **MIDIPLAY** for Atari ST (\$49.95), this company is releasing **MIDI Editor** (\$89.95). They also have a collection of Musidisks ranging from Bach to the Beatles, as well as a selection of Disney songs, for \$19.95 each.

CIRCLE 179 ON READER SERVICE CARD

Hybrid Arts

11920 W. Olympic Blvd.
Los Angeles, CA 90064
(213) 826-3777

Hybrid Arts has a collection of both hardware and software products for the electronic musician of any level. Hardware selection includes **ADAP** (\$1995), an input/output signal processor. They have a patch editor for the Casio **CZ** series, **CZ-Android** (\$99.95) and **DX-Android ST** (\$199.95) for the Yamaha **DX** series. The December 1986 issue of **Antic** calls **EZ-Track ST** (\$65.00) "an excellent, simple program." This is a good package to start out with; after you grow more comfortable with MIDI you can upgrade to **Sync-Track** for \$375 or **SMPTE-Track** for \$575. Hybrid Arts also sells MIDI cables (\$4.95).

CIRCLE 180 ON READER SERVICE CARD

XLEnt

P.O. Box 5228
Springfield, VA 22150
(703) 644-8881

Len Dorfman and Dennis Young designed **ST Music Box** (\$49.95) for the beginner.

CIRCLE 186 ON READER SERVICE CARD

Key Clique

3960 Laurel Canyon Blvd.,
Suite 374
Studio City, CA 91604
(818) 905-9136 technical support
(801) 566-1683 orders

Key Clique's **SYS/EX** (\$150) is a user-upgradeable patch librarian.

CIRCLE 181 ON READER SERVICE CARD

Micro W Distributing

1342B Route 23
Butler, NJ 07405
(201) 838-9027

Remember the old piano player rolls?

This enterprising company has taken some of the music from that genre and put it on disks of six songs each, available for \$19.95. You can play the music using either their **MIDI Magic** (\$39.95) or **START's** own "A MIDI Sequencer" by Tom Jeffries (issue 1).

CIRCLE 182 ON READER SERVICE CARD

MIDIsoft

P.O. Box 1000
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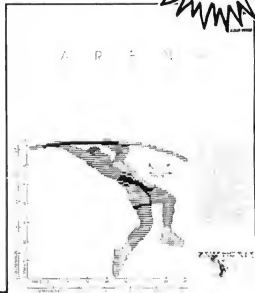
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PRINTER DRIVERS THE EASY WAY

A DEGAS PRINTER DRIVER MAKER PROGRAM

by **TOM HUDSON**
Contributing Editor

If you've ever tried coding something as complex as a screen dump program in 68000 assembly language, you've probably come out of the experience with:

- Less hair on your head and fist-sized balls of same on the floor,
- A peerless command of four-character words,
- A familiarity with the little 'cherry bomb' icons that enables you to draw them perfectly, down to the last pixel, weeks later.

I know I have.

Writing screen-dump printer drivers is not fun. I don't like doing it. I'd rather be doing fun things like coding ray-tracing graphics demos. Really.

I know most START readers aren't thrilled with trying to write their own screen dump routines, either. Since writing the printer driver installer program in START (see "Stealing the ST Printer Driver", START #1, Summer 1986), I keep getting calls from the technical staff saying, "Hey, somebody with

Stuck with an oddball printer for your ST? Weep no more. If you're having trouble finding a DEGAS printer driver for it, then this program should cure your pin-head blues. Just open the folder marked **PRINTER.ST** on your START disk, and you'll soon be able to custom-design your own driver, no matter what printer you have.

a Froom 2000 printer with a 19-pin printhead wants to know how to modify the Epson driver . . ." I usually crackle cellophane over the phone mouthpiece to simulate a bad connection and pull the cord from the wall.

After I plug the phone back in several hours later, the technical staff at Batteries Included will call. "Customer Support says people are asking for a printer driver for the Froom 1999 printer (which, incidentally, is completely different from the Froom 2000). Want to write one?" I feign ignorance of the ST altogether ("520 what?!"), tell

them my name is Attila Freen and that they have the wrong number, and hang up.

You can only run for so long before the inexorable forces of the universe catch up with you.

I was in the mood to buy something one day recently, and that something was a 24-pin NEC P6 printer. Of course, what good is a 24-pin printer without screen dump software? Naturally, none of the previous printer drivers I had ▶

 Folder **PRINTER.ST**
on your START disk

DRIVERS...

written could be easily modified to work with 24 pins, so I was stuck. I was going to have to sit down and write a driver for it. Not only was I going to have to write one driver, but since I wanted printouts in six different sizes, I had to write *three* (two sizes per driver)! That meant lots of hair to vacuum, neighbors complaining about the noise, and literally *hundreds* of cherry bombs! Yucch!

Reluctantly, I sat down and started flowcharting the driver code. Suddenly, and without warning, it became readily apparent that the code could be set up so, with changes to appropriate constants throughout the code, it would work with just about any printer I was saved! I could have all three of my drivers with a minimum of effort. Batteries Included Customer Support would get off my back. The guys at START would do flip-flops!

The code sprung from my brain and into the computer and worked the first time.

Actually, I pulled out my hair and cursed and watched a lot of cherry bombs dance across my screen for the next few days, but it was worth it. (Editor's note: *The following program can*

be used in conjunction with Darrel Anderson's "Black And White In Color: Capturing Your ST's Graphics On Print And Film!")

THE PROGRAM

What we have here is a program that writes printer drivers for you. The novice computer user can probably do all the necessary research on the desired printer and create a working driver in half an hour. I personally know of computer experts who have done it in five minutes. These are estimates only; your actual time may vary.

The program works with any printer having from 1 to 24 pins in the print-head (I probably would have just taken the easy way out and done it for 8-pin printers, but hey—my printer had 24. And I wasn't about to custom-code three drivers. No way.)

It will build drivers that will print screen dumps all the way up to 4160 printer pixels wide, if you have a wide-carriage printer. (Posters, anyone?)

The main limitation is it works with printers which use an Epson-style command format. That is, for each pass of the print head, you tell it how many bytes there will be

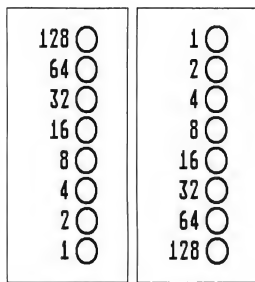


FIGURE 2A

FIGURE 2B

FIGURE 2

in the graphics data, then send that number of data bytes. Printers like some members of the Okidata Microline series, which use strange and bizarre control codes that can't be included in the graphics data, won't work. Back to hair-pulling. Most printers these days use the Epson method, so that isn't a huge limitation.

You can customize your drivers to do just about anything. If you want a form feed before the dump, you can do it. If you want a form feed after the dump, you can do that, too. Want funny spacing? You've got it. It won't paint ceilings. It won't wash windows.

GET IN AND DRIVE

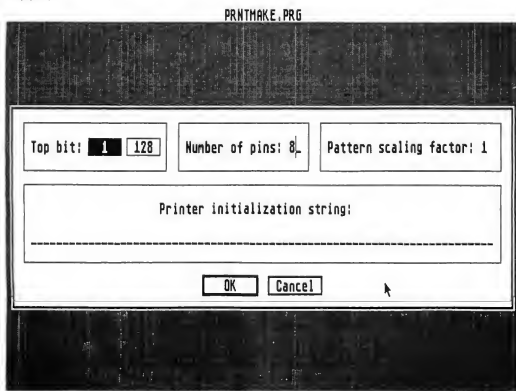
To make your own drivers, just double-click on the PRNTMAKE.PRG icon while running in medium or high resolution. Low resolution does not allow the large dialogs to fit on the screen, and if you try running in low-res, you'll get a rude message.

You'll soon be greeted by a dialog box which gives the program credits and gives you the option of continuing or bailing out. You can quit if you want, but I'm clicking on the "Continue" button.

The first dialog you'll see is shown in Figure 1. This is general data for the printer and information it needs to initialize itself.

Now is a good time to get out your printer's manual. A short prayer

FIGURE 1



wouldn't hurt, either.

The first section of the dialog, which lets you tell the program about the orientation of your print head (actually, the printer's), is the trickiest part of this dialog. Your print head can have one of two orientations, with the 128 bit on the top, or the 1 bit on the top. Take a look at the "Graphics" section of your manual, and look for a diagram similar to that in Figure 2. Figure 2a has the 128 bit at the top, and Figure 2b has the 1 bit at the top. With your mouse, click on the appropriate button to select the top bit of the head. Most printers I've used (Epson, NEC, etc.) have a head with a top bit of 128. Printers like the C.ltoh/Prowriter 8510 series have a top bit of 1.

Next, you need to set the number of pins in the print head. Once again, consult your printer manual. This will usually be 8, 16 or 24 pins. Just type in the number of pins (the default is 8).

You can only run for so long before the inexorable forces of the universe catch up with you.

You can use any number up to the maximum used by the printer, but the program is most efficient if you use all of the pins in the print head.

The next data field in the dialog, "Pattern scaling factor," allows you to change the size of the pattern used to represent gray-scale in color printouts. I recommend leaving this value at one, but if you have a 24-pin printer which runs its pixels together at small scaling factors, you can increase this value. Sim-

ply move the cursor to the field with the up- or down-arrow keys or by clicking the mouse on the number. This value can range from one to nine.

Finally, you need to input a string of numeric values necessary to initialize the printer and set the line feed length. This string is simply a group of decimal numbers (not hexadecimal or binary) separated by commas, like so:

27.64,27.51,24

This is the initialization string for the NEC P6. The 27.64 is an [ESC] @, which initializes the printer to its power-up settings. The 27.51 is an [ESC] 3, which is the linefeed setting command. This is followed by a 24, which is the number of pins to advance the paper every time the printer receives a line feed code. Enter the appropriate values for your printer here. The only values permitted are numeric values from 0-255, separated by commas. Spaces are ignored, but not recommended.

You can put other things in the initialization string, as well. Some people might want a form feed before a screen dump to place it on a new piece of pa-

per. If so, you just need to add a 12 (ASCII form feed) to your init string, like so:

27.64,27.51,24,12

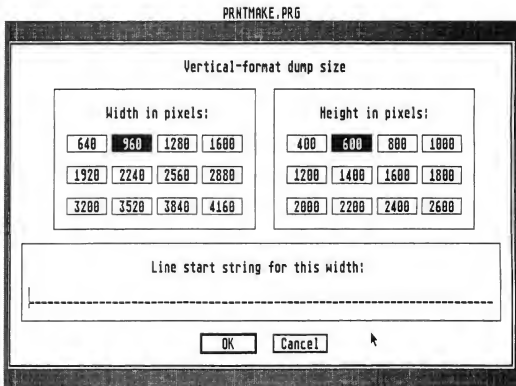
After you set all four fields to the desired values, click on OK or press [RETURN]. The program will examine the data and report any errors. If you make a mistake (by entering non-numeric data or an out-of-range value), the program will tell you and let you try again.

THE SECOND DIALOG

This is another large dialog, shown in Figure 3. It lets you tell the driver the size of the vertical-format screen dump, which you get when you activate the printer driver with the Alternate key pressed. This is a right-side-up printout (i.e. it looks correct coming out of your printer).

In this dialog, you must tell the driver how many printer pixels wide and tall the printout is to be by clicking on the appropriate numeric box. The numbers you choose will depend on the printer you're using. Printers which have a one-to-one aspect ratio (that is, ▶

FIGURE 3



DRIVERS...

10 pixels aligned vertically are the same length as 10 pixels aligned horizontally) use the numbers which are in the same position in the width and height selections (640/400, 960/600, etc.) There's no good way to determine this beforehand, so I suggest setting the width and height to the same positions initially, then adjusting the height up or down if the printout is too short or tall.

Once you've determined the width of the printout, you need to set up the line start string for that width. This is the information which tells the printer the number of pixels wide the graphics dump will be. You'll have to consult your manual again for this string. In most cases, you'll have to send an escape code followed by a pixel count indicator, like so:

27,42,39,128,2

This is the NEC P6 graphics start string for a 640-pixel line. The 27,42,39 (ESC * *) places the printer into the triple-density graphics mode, and the 128,2 tells it there are 128+(2 * 256), or 640 pixels in the print line. For a typical Epson printer, this string would be:

27,76,128,2

The 27,76 (ESC L) selects double-density graphics mode, and the 128,2 once again represents 128+(2 * 256) or 640 pixels. Check your manual for the proper start string. Be sure the number of pixels matches the width in pixels you have selected, or the driver will do funny things, like lots of random form feeds. Take it from me—you don't want that to happen.

When you have completed the vertical-format dump dialog, click on OK or press RETURN. The program will check your work and report any errors.

DIALOG NUMBER THREE

The next dialog box is almost identical to the vertical-format dialog, but is used to set the values for a horizontal-format screen dump. This is the default dump that the driver will produce, and is oriented sideways on the paper. If you size it properly, you can just about fill an 8.5x11-inch page.

Like the vertical-format dialog, you must click on the appropriate width and height for the printout, in printer pixels. You'll usually want to make the

horizontal-format printout a different size than the vertical-format dump, just for a little variety. The aspect ratio rule mentioned earlier still applies here: Select the width you need, then adjust the height accordingly after testing the dumper.

The line start string is just like the vertical-format start string, except that the pixel count must match the width of the horizontal printout. For an 800-pixel-wide horizontal dump on the NEC P6, the start string would be:

27,42,39,32,3

Once again, the 27,42,39 is an ESC * ; which places the printer in graphics mode. The 32,3 is the pixel count, which works out to 32+(3 * 256), or 800.

After completing the dialog, click on OK or press IRETURN. Your work will be checked. If it passes inspection, you move on to the next dialog.

THE NEXT DIALOG

Well, here we are at the next dialog. This is shown in Figure 5, and is a very simple format.

This dialog allows you to input two miscellaneous strings. The first is the string used to terminate each graphics line. Normally, this will be:

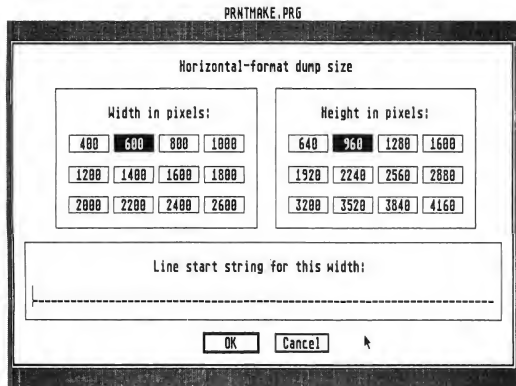
13,10

which is the ASCII carriage return/linefeed sequence. This returns the carriage and advances the paper one line (be sure you set the linefeed to the proper length in the initialization string!) You can set this string to whatever is necessary to terminate the graphics line on your printer. If you just need a linefeed, you would just enter:

10

The last string you can enter is the clean-up string. This is an optional entry, and if you enter it, it is sent after the

FIGURE 4



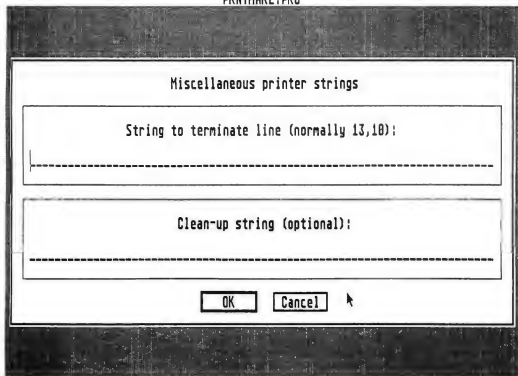


FIGURE 5

screen dump is complete. If left blank, nothing happens, and the printer is left as it is right after the dump is completed. It's a good idea to at least reset the printer to its power-up state at the end of the dump so that you can return to normal printing after doing the dump. For the Epson and compatible printers, this would be:

27,64

This is an ESC *, which resets the printer to the power-up state. You can add other things to this string, such as carriage returns, form feeds, and so on, if the mood hits you.

Click on [OK] or press [RETURN] to exit the dialog.

TESTING THE DRIVER

Now comes the moment of truth. Your palms are sweaty, your heart races. Will it work? Well, it probably won't cause the screen to fill with cherry bombs, which is at least something. You should now see the test/save dialog on the screen, shown in Figure 6.

This dialog box lets you test fully the printer driver in all three resolutions, regardless of the resolution being used.

If you have properly entered the information, your eyes will be greeted with startling images that virtually leap off the paper. If not, your eyes will be greeted by pixel-sized garbage. Well—think positive.

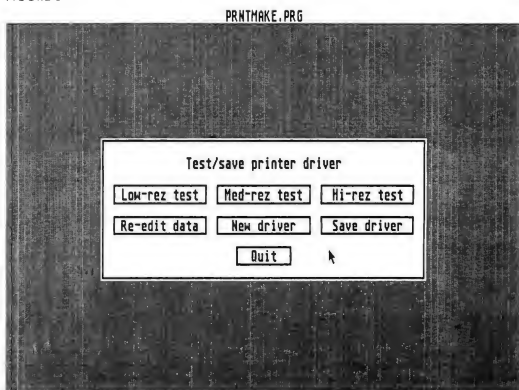
It may be a good idea to run back through the data you entered before testing the driver. To do this, click on the "Re-edit data" box. You will be

returned to the first dialog box. Check over the data you entered, and click on the OK boxes to advance through the dialogs. If you spot something wrong, you can easily correct the data.

Once you're ready to test the driver, click on either the low, medium or high resolution test buttons. A file selector dialog will appear and you can select a DEGAS normal or compressed picture to use as the test image. The picture will not be displayed on the screen, so you can test any resolution regardless of the monitor you're using. After you select the picture to print, a small box will appear prompting you to press the [Alternate] key if you want a vertical format dump, or just click to do a horizontal format dump. It's a good idea to test the driver in both horizontal and vertical format, in all three resolutions.

After you start the printout, your printer should start dumping the image. If it looks OK, let it continue to completion. If something looks wrong, or you're just getting a page full of garbage, press the UNDO key. The printout will stop and you'll return to the test/save dialog. Use the "Re-edit" button to re-check your ▶

FIGURE 6



DRIVERS...

data. Most often, the problem will be with the line start string for the format being tested, in the numbers which tell the printer the number of pixels in the graphics line.

If the printouts are OK, you can save the driver to a .PRT file. Use the "Save driver" selection to do so. Be sure to use an extension of .PRT on the file. After saving, the printer driver is ready to be used by DEGAS, DEGAS Elite, the START printer driver installer (START #1), or any other program using DEGAS-format drivers.

Got more drivers to build? No problem. You can use the Re-edit button to change the data for another driver to use with this printer, or you can use the "New driver" button to start over with a clean slate. You can also return to the desktop by using the "Quit" button.

TROUBLESHOOTING

If your printer driver does not produce a proper image, with garbage characters mixed with graphics, re-check the graphics start command and make sure the number of pixels in the start command match the width value you have specified for the two dump formats. The start string for each of the formats will be different, so be sure to check them!

It's more than likely that you'll need to fine-tune your printer driver. This will usually be an adjustment of the width or height of the printout to make it appear to be the same aspect ratio as the screen. Most printers will allow you to get close to the screen's aspect ratio, but won't look exactly correct. This is normal.

To adjust the aspect ratio to be as close as possible, most printers have several different horizontal resolutions. 60 dots per inch (DPI), 120 DPI, 180 DPI and so on are common. You can adjust to the different settings offered by your printer to get a good image.

As an example, the Epson series (such as the MX-80) uses the following settings:

Top bit: 128
Number of pins: 8
Pattern scaling factor: 1
Initialization string: 27,64,27,65,8

Vertical format width: 960
Horizontal format height: 400
Vertical format start string: 27,76,192,3

Horizontal format width: 800
Horizontal format height: 640
Horizontal format start string: 27,76,32,3

Line termination string: 13,10
Clean-up string: 27,64

This should be a good starting point if you have a printer that can emulate the Epson series.

WHAT TO DO WITH IT?

Once you've made your own printer driver, now what? Well, using the printer driver installer from START #1, you can install your new driver as the system's driver, and print just about any ST screen. If you're a member of a telecommunications network, such as CompuServe or GENie, you can upload your driver so that others can share it. You can also hang around on street corners: "Psst! Hey mac, wanna Froom 2000 printer driver?"

And best of all, you didn't have to touch one line of 68000 assembly language code. Your scalp, the neighbors and the RESET button on your system will all thank you.

THE GORY DETAILS

If you don't need to know how the printer driver maker works, don't read any further. Go play with your printer driver and have fun. The rest of you read on.

This program is composed of two primary sections. The first is the main user interface module, which is written in C. The second is the printer driver skeleton, an assembly language routine which has a number of "slots" which

have the various parameters and printer codes inserted into them. Once the driver skeleton is "fleshed out" with the appropriate information for the printer and printout size, it is written to disk in a 2000-byte printer driver file. This file is then ready for use. The driver code is position-independent. That is, it can be loaded at any point in memory and it will operate without modification. For information on how the printer driver is called, see "Stealing the ST Printer Driver" in START #1.

THE USER INTERFACE

The user interface of the program was written in C to make programming it easy. It is written so that the GEM resource data for the dialog boxes could be included (via the .RSH file output by the GEM Resource Construction Set). This lets the program be set up as a single .PRG file without requiring a separate resource file. Because the resource data is not loaded with the `rsrc_load()` function, the locations of the objects must be calculated. This is done right before the workstation is loaded.

The C source file, PRNTMAKE.C on the START disk, starts with a list of externally-defined labels. These are defined in PMASMS, the printer driver skeleton source file.

This is a mostly straightforward GEM application, so I won't go into a lot of unnecessary details. Most of the program is dedicated to the actual dialog box processing, which handles the input of the strings from the user. After being entered, the strings are processed by the "nparse()" function. This is a handy routine which converts the ASCII strings of numbers separated by commas to actual strings, ready for use.

To test the driver, the program uses the "inst_codes()" function to plug the various values into the printer driver skeleton. Once these values are loaded into the skeleton, the driver is ready to go.

To load a DEGAS normal or compressed picture, the program uses the DEREADC source file. This is a set of routines that will load a DEGAS picture whether it is compressed or not. The "get_pic()" function, documented in DEREADC, does the loading of the image. The DEREADC routines require the use of an assembly-language memory mover, "movem()", which is defined in the PMASM.S assembly-language source file. Savvy programmers will notice some of the routines used in the DEREADC file are the same as those in the IFF loader routines from START #2 ("Swapping Art With Other Computers"). That's because the DEGAS Elite compressed format is the same as the IFF compression scheme. It basically makes life a little easier and avoids duplicating code when doing IFF and compressed DEGAS file reading in the same program.

THE SKELETON

In order to allow the printer driver maker to create printer drivers that will work with many types of printers, it was necessary to allow a great deal of flexibility. This causes printer drivers created with this program to operate somewhat more slowly than those which are hard-coded for a particular printer, but the speed difference is not extreme.

The printer driver skeleton is in the PMASM.S file. As expected, the skeleton has a large number of globally-declared locations used by the C program to store the various parameters for the driver. The parameter values are immediate-format 68000 instructions, and when the C program stores the values, it replaces the dummy immediate values in the skeleton with the actual values. Throughout the skeleton code, you'll see immediate values that are #S1111 or #S11111111. These will be replaced.

To provide the ability to produce 16 sizes of printouts, the printer driver sets independent repeat values for the odd

and even screen pixels of both X and Y axes. On a high-res screen, for example, the width can be 640 (odd repeat=1, even repeat=1), 960 (odd repeat=1, even repeat=2), and so on. The various odd and even repeat values are found in the inst_codes() function in the PRNTMAKE.C file.

The main body of the skeletal printer driver processes each pixel on the screen with the proper repeat values first in the Y direction, until the print

**The novice
computer user can
probably do all
the necessary
research on the
desired printer and
create a working
driver in half
an hour.**

head is filled. The print head data is then dumped, and the program advances to the next X pixel (or repeats the current X pixel if necessary), returning to the top of the print head. When an entire line of data is printed, the end-of-line string is printed and the program moves to the next line.

Separate X and Y coordinate values are kept for the printer, allowing the shading pattern to maintain the highest resolution of the printer, even though a screen pixel may take up as many as 169 (13 * 13) printer pixels. The printer X and Y coordinates are used to index into the grey-scale pixel table, and by dividing the printer coordinates by the pattern scaling factor, the patterns can be made larger or smaller.

The data sent to the print head is held in the LONG variable BUFFER until it is ready to print. The HEADMASK variable holds a LONG mask with one bit on which is ORed with the BUFFER contents when the corresponding pin in the print head should be fired. The HEADMASK variable is shifted right or left, depending on the orientation of the print head (1 bit/128 bit up). The shift instruction (left or right) is grabbed by the C program from either the _lshift or _rshift labels and is plugged into the skeleton at the _SHIFT label. When the HEADMASK is at the end of the shift range, the BUFFER is sent to the printer (only the proper number of bytes for the print head size are sent), the BUFFER is cleared, and the HEADMASK is reset.

Once parsed from the strings of numbers separated by commas, the various strings used by the program are stored in order at the _STRINGS label, and their offsets from the _STRINGS label are stored in various places around the program (_VSOFF (vertical start offset), _HSOFF (horizontal start offset) and so on). Their lengths are also stored similarly. When they need to be printed, the program BSRs to the gettab routine, which points register A3 to the _STRINGS label. The offset of the required string is added to the base address, the length of the string is placed in register D2, and the string is printed using the "printit" subroutine.

THAT'S ALL, FOLKS

That just about covers the printer driver maker. C purists are probably gasping in horror at the GOTOs in the C section, but I'm not going to make any apologies. The program does what it should, and is still readable. The various routines included on the START disk, such as the DEREADC file, will probably come in handy for many readers.

If you have any questions on the program or lavish praise, I can be reached on CompuServe. My user ID is 76703,4224. ■

DISK INSTRUCTIONS

Prepare yourself.

Every issue of *START—The ST Quarterly* contains articles written by some of the finest developers and writers in the Atari computer community. Many of these articles are programming tutorials, detailing how the wizards of the Atari world practice their arcane art. And anybody can benefit from the disk—we provide everything from tax templates for your spreadsheet to full-featured word processors, easy-to-use drawing programs and spectacular graphics demos.

START—The *ST Quarterly* was designed as a magazine with disk, containing the finest *ST* programs available. If you purchased the \$4 nondisk version of *START* you can still obtain the disk by sending us the bound-in order card or mailing \$10.95: *START DISK #4*, 544 Second Street, San Francisco, CA 94107. (Be sure to specify the disk you want.) Note: If you want *same day* service, call (415) 957-0886 and ask for the Disk Desk. Give us your MasterCard or Visa number, and we'll ship your *START* disk out that very day!

All programs on the *START* disk are for your own *private* use, and are not public domain. We ask that you please *not* copy your disk for your friends, accept a copy from someone, or upload these programs on a bulletin board system. The more people who do this, the more difficult it will be for us to afford to bring you quality *ST* programs and incisive technical material. Software piracy hurts everyone.

Use scissors to open your disk envelope along the outside vertical edge. Place your *START* disk into drive A and double-click on the disk icon to see its contents. Please refer to your *ST* owners manual if you are uncertain about proper Desktop procedures.

Important! Before you do anything else, *back up your START* disk. It is not copy protected. Format a fresh disk as single-sided, and copy your entire *START* disk to it. Finished? Now place your original *START* disk back inside its envelope, and begin using the new copy.

Your *START* disk contains eight folders. Each folder corresponds to a particular *START* article. To open a folder and reveal its contents, double-click on the folder's icon. Before running a program, we recommend you read its related article and transfer its files to another disk.

WHY COMPRESSED FILES?

Our quest for *ST* excellence has had its drawbacks. Each issue we face the same problem—how can we get as many fantastic programs as possible to fit on a single-sided disk and deliver it out to our readers? The solution? Some of the files on the *START* disk are in a compressed format. You can identify

them by a "Q" as the second letter of the filename extender (e.g., MAILCALL.PQ5). These files are unusable unless first decompressed with the Un-Squeeg program included on your *START* disk. Only the Un-Squeeg program (the decompressor) has been included on your disk. Please note that this program is owned and copyrighted by the Quack Computer Company and is not to be considered part of the public domain. The latest Squeeg/Un-Squeeg package (version 3.1), which includes the compression program, is available for \$24.95 from:

Quack Computer Company
257 Robinson Avenue
Bronx, New York 10465

DECOMPRESSING

To decompress a file, first transfer both the compressed file and UNSQ31.PRG to another disk. When run, the Un-Squeeg program will create a second, decompressed file which may be more than twice the size of the compressed one. Un-Squeeg will *not* alert you if you run out of disk space, so make sure you have plenty of room on your destination disk.

Make sure you run UNSQ13.PRG from disk drive A:, and decompress files onto the A: drive. Not drive B:, and most certainly not from a C: or D: RAM or hard disk. File damage may result from operation from a disk drive other than disk drive A:.

After transferring the files, double-click on UNSQ31.PRG and a file selector box will pop up requesting the file to decompress. Un-Squeeg automatically searches for filenames with "Q" as the second letter of the extender. Select a file to decompress and click in the [OK] box. Un-Squeeg then presents a file selector box for you to enter the name of the decompressed file. However, Un-Squeeg inserts the original filename on the filename line, so it's easiest to just click the [OK] box. You must not run Un-Squeeg from within a folder, or ask it to access a compressed file inside a folder. It must be run on the root, or first, directory available on a disk.

Un-Squeeg will then read in, decompress, and write the new, uncompressed file to your disk. Again, make sure you have plenty of room.

THE DISK

- UNSQ31.PRG—The Un-Squeezzer. Double-click on this to decompress a file.
- COLORPR.ST—With the sample file in this folder Darrel Anderson helps teach you how to produce full-color printouts with your black and white printer. (You might need sunglasses to cut down the brilliance of the printed results!)

DISK INSTRUCTIONS

You'll find one squeezed picture inside:

TESTPRNT.PQ2—the squeezed medium-res DEGAS picture.

- DISK.ST—Dave Small and Dan Moore wring 40K more bytes out of the ST disk, while maintaining compatibility with TOS, and yet manage to double their disk access times. They make TOS stand on tiptoe and deliver hard disk backup at over a megabyte-a-minute. Want to duplicate their results? Try these:

BACKMAKE.MQ—a "make" file, for creating the backup program.

BACKUPCQ—C source code for the backup program.

BACKUPDQN—the squeezed "DFN" file the Resource Construction Set (RCS) program needs.

BACKUPPQG—the runnable Backup Program.

BACKUPRQC—the Resource File for the Backup Program.

MMTWTWCQ—inline assembly in Megamax format for TWISTER.C and BACKUPC.

PROTECT.ACC—an accessory to "write-protect" your Hard Disk.

PROTECT.CQ—the C source code to create the accessory.

PROTECT.DQN—the squeezed "DFN" file an RCS program needs.

PROTECT.RQC—the Resource file for the Protect Accessory.

REBOOT.SQ—assembly source code for the Rebooter program.

REVIVE.CQ—the C source code for the reviver program.

REVIVE.PQG—the Reviver program itself.

TWISTER.C—C source guaranteed to twist your disk.

TWISTER.DQN—the squeezed "DFN" file an RCS program needs.

TWISTER.PQG—the Sector Twisting program.

TWISTER.RQC—the Resource file for the Sector Twister.

TWISTER.MQ—the "make" file for creating TWISTER.PRQ.

- ICON.ST—Alex Leavens worked very hard to satisfy us on this one. Step right up and design your own personal icons for your Desktop, with the help of the five different files inside this folder:

EDITIME.RQC—the main program's Resource File.

EDITOR.AQC—the editor program, in Accessory Format.

ICON.DQT—actual picture information for sample icons.

LOADICON.AQC—the Accessory program to load your new icons.

MAKEICN2.IQS—the TOS version of the Icon Designer program.

- MACROPIX.ST—When Dale Giarratana submitted this program to Antic Magazine, they were overwhelmed. "This is too

much for our readers!" they exclaimed. "Get thee to START Magazine!" We were impressed. Here, in one Personal Pascal program, is a nice introductory object-oriented drawing program. Here are the files for it:

MACROPIX.PQG—the finished, squeezed, MACROPIX program.

MACROPIX.PQS—the Personal Pascal source code. A whopper!

TEST.DCL—color palette used in sample picture.

TEST.DDR—MacroPix sample picture.

TIME.INF—the file containing MacroPix's time delays.

- PRINTER.ST—Tom Hudson is amazing. Without any prompting from us, he pops up with a program which actually creates printer drivers which DEGAS and the Atari Screen Print driver can use. Now you, your oddball printer and DEGAS can all sleep easy, with the help of the six files Tom sent to us:

DEREAD.CQ—C source for reading DEGAS Elite compressed Pics.

PMASM.SQ—Printer Driver Maker assembly source code.

PRNTMAKE.CQ—the C source for the Printer Driver program.

PRNTMAKE.DQN—the squeezed "DFN" file an RCS program needs.

PRNTMAKE.PQG—the runnable Printer Driver program itself.

PRNTMAKE.RQC—the Printer Drivers' Resource file.

- RAYTRACE.ST—Have we mentioned Tom Hudson was a genius? In between turning out hits like DEGAS Elite and CAD-3D 2.0, he casually views the Xanth "Shiny Bubbles" demo, then goes home and writes a complete set of programs which allow you to design and turn out ray-tracing animations yourself. We'd like you to see what you can do with it! You'll need the following four files:

EXAMPLE.CTL—the "script" you'll need to create your own ray-trace demos.

TRACEASM.SQ—assembly source code for the tracing routines.

TRACER.CQ—the ray-trace program in C source code form.

TRACER.PRQ—the runnable ray-trace program itself.

- TAX86.ST—Only two things certain in life, and the other is taxes. To help make the best of a sticky situation, we present here Schedule Sheets for the 1986 US Income Tax form 1040, arranged in the VIP Professional format "WKS" file. This is a large file, so make sure you have lots of room for decompression. There's only one file inside the folder:

TAX86.WKS—the spreadsheet. ■

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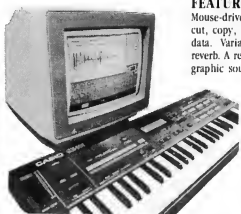
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Black And White In Color

Capturing your ST's graphics on print and film

BY DARREL ANDERSON

Saddled with a black and white printer, but desire color graphics? Let professional artist Darrel Anderson teach you how to produce beautiful color printouts with your ordinary dot matrix printer. Also, check out his tips on capturing spectacular ST graphics with a 35mm camera.

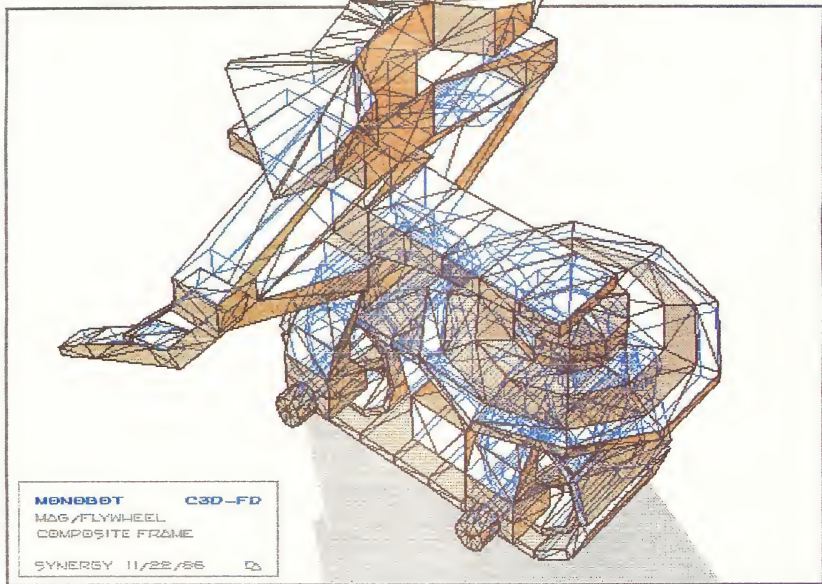
A sad truth—not everyone owns an ST. The excellent graphic capabilities of these computers would be of very limited value if they only took the form of on-screen images. Fortunately, there are many ways to transform those images into more widely accessible media. The most commonly available output devices offer not only the ability to capture your screen images, but also the opportunity to enhance the color and resolution capabilities of the ST. The techniques described here even allow those working with monochrome monitors to produce high resolution, full-color graphics.

One of the primary uses for my ST is producing illustrations for publication. It joins an array of other tools, mostly traditional, that can be used in combination to create visual art in many different forms. Some type of “hard-copy” is usually the link required to make the images transferable to other media, and available to people without computers.

In this article I discuss two forms of graphic output: standard (single color) dot matrix printers, available to most users and capable of producing surprising results when used creatively, and screen photography, the easiest and least expensive way to capture the true color and luminous quality of screen images.



Folder *COLORPR.ST*
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Above image produced with Cyber Studios' CAD 3-D and The Future Design Disk, available from The Catalog. Artwork by Darrel Anderson.

PRINTERS

While not the purpose of this article to review or recommend specific printers, I thought it might be helpful to provide a brief overview of printer types and their respective advantages and disadvantages re: graphics. Please look at the REFERENCE section at the end of this article for additional information.

There are five basic types of commonly available printers: plotters, ink jet, thermal, laser, and impact. Let's take a look at each type.

Plotters transfer computer generated images to paper by literally drawing on the paper with ordinary ink pens attached to mechanical arms. They are especially useful for technical illustrations or drafting applications. Any linear-based graphics, or vector-based software (such as Tom Hudson's CAD-3D), can produce impressive plotter output. Most quality plotters are expensive and have very limited text capabilities.

Ink jet printers spray liquid ink onto paper through tiny "jets" or nozzles. They produce a very clean, "tight" image, and many are capable of very high resolution output. Again, quality models tend to be expensive, inexpensive ones tend to be troublesome and difficult to maintain.

Thermal printers come in two types: those that use heat-sensitive paper (usually expensive, and it fades rapidly), and the more practical and versatile thermal transfer type, that can print on any paper, using heat-activated ribbons. Of particular note to ST users is the Okimate 20 (see the sidebar), an inexpensive machine with good graphic capabilities.

Laser printing is the state-of-the-art technology. These printers are clean, quiet, and produce very sharp, high-quality output. Currently they are very expensive, but look for prices to drop as these machines vie to become the new standard.

Impact printers transfer ink to paper by striking an inked ribbon. These printers come in two basic types: daisy wheel and dot matrix.

Black and White...

Daisy wheel printers use raised letter-forms, like those in typewriters, to impact the ribbon. Dot-matrix impact printers, the most common, use groups of small wires or pins that can be fired in any sequence, forming a variety of graphic patterns including, but not limited to, letter-forms. The number of pins in the printhead determines the tightness or resolution of the dot patterns. The more pins, the better. Most printers fall in the range of 8-24 pins. Some have color graphic capabilities, usually involving a multicolored ribbon that lays down each of 3 or 4 colors with repeated passes of the printhead. Price is often linked to these two features: number of pins and color capability.

MULTI-PASS PRINTING

I've never been truly impressed with the output of any color impact printer. Inherent printing limitations make these printouts very unsatisfying, especially when compared to the on-screen source images. This limitation set my innovative gears in motion. I developed some special techniques that utilize various single color ribbons and a standard one-color dot matrix printer to create very pleasing full color graphics. These methods can also be used to improve the quality of black and white graphics.

Anyone who has tried to use printouts as originals for further reproduction, by photocopying or offset printing, knows the problem. After only one or two full-page printouts the ribbon develops weak spots. This causes grey areas in subsequent prints, which in turn leads to a broken-up image when reproduced. By reprinting the entire image, reproduction

quality prints can be made from an otherwise worthless ribbon. Therefore, don't throw away any ribbon, black or color, no matter how tired it is. They're all useful in multi-pass printing.

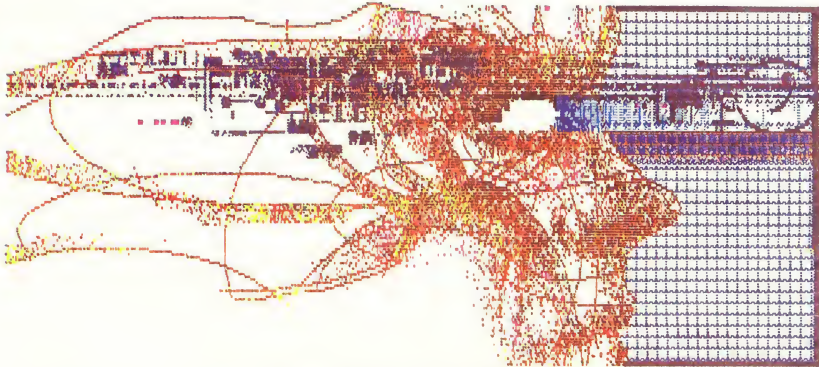
These techniques don't overcome all of the limitations causing printouts to fall short of the brilliance of screen images. If that's really what you want to capture, look at the screen photography section in this article. If, however, you are interested in producing quality color graphics on paper with your simple printer, and are willing to do a bit of creative work to achieve those results... stay tuned.

The examples shown here are produced with the Epson LX-80 using DEGAS Elite and its Epson black and white driver. The techniques should work with just about any dot matrix printer/graphics program/driver combination. (For more information on how to use your particular printer with DEGAS Elite, see Tom Hudson's "Printer Drivers The Easy Way: A DEGAS Printer Driver Maker Program," in this issue.) Exact methods will vary with different systems. The basic idea is to run the same sheet of paper through your printer several times (once for each color) using the various single color ribbons available for most printers.

SETTING UP AND TESTING

The first step in this process is testing. By determining the capabilities of your printer you'll be better able to design graphics for print. A selection of color ribbons (see REFERENCE section), some good continuous feed 9½x11" paper, and your favorite drawing or paint program are needed to run

Sample printer output.



these tests. Any good black and white graphic printer driver will do the job. I've included a special DEGAS test picture file, TESTPRNT.PQ2 in the COLORPRST folder on your START disk.

Since we want to overprint several colors, we need a registration system (a way of aligning the paper with the printhead for each successive color pass). Most printers have a form feed function that makes this fairly easy to set up.

With an Epson LX-80 equipped with tractor feed it's possible to set up a continuous paper loop, providing excellent registration. Registration without tractor feed is possible, however the inaccuracies of friction feed make it a touchy and less consistent prospect.

THE PAPER LOOP

Tear off three sheets of good quality, continuous feed paper (I've been using a 20 lb. 25% rag bond). Apply a strip of transparent tape to the back side of the bottom sheet of your paper loop (see Figure 1), so that half of the tape strip is exposed. Now load the paper as you normally would, feeding the un-taped top sheet into the paper slot. Feed the paper through until about half of the top sheet extends beyond the

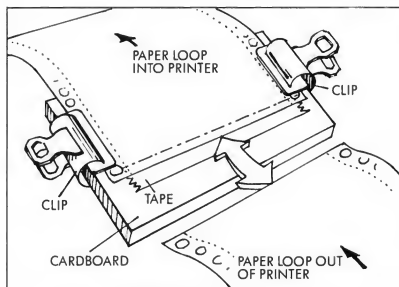


FIGURE 1

form feed is not exact. The real test of accuracy will come when we do the color test. If you are unable to set up a paper loop on your printer you can still create multi-pass prints by manually backing up the paper to a predetermined position prior to each pass.

PRINTING

Now we're ready to print. Unsqueeze and load the TESTPRNT.PQ2 file into DEGAS in medium resolution mode. The vertical bar of empty labeled boxes is designed to show a few of the possible colors using yellow, red, and blue ribbons. These primary pigments offer the greatest range of color mixes. Other colors are certainly useful. There are at least eight available (counting black) for the LX-80.

To achieve color mixes we're combining several screen images, one for each color ribbon used. Each screen image is done in shades of grey representing the value or darkness of a particular color. In print terminology these images are called "overlays." A sample set of overlays is included in the TESTPRNT.PQ2 picture.

The standard DEGAS black and white printer driver for the Epson has an eight level grey scale. A color ribbon, say red, translates to eight shades or values of red. Multi-pass printing allows us to combine any of those reds with any of eight values of up to seven other ribbon colors. Theoretically this gives us thousands of colors to choose from. When printed out, however, many are indistinguishable shades.

To simplify things I usually work with color mixes composed of solid (0,0,0 palette setting on screen) and one or two values or halftones. I prefer the printer pattern generated by a palette setting of 3,3,3, which produces a smooth dot pattern on the Epson. Sometimes the 4,4,4 and 5,5,5 settings are useful. If you're using a different printer or driver do a simple test print consisting of small boxes of each of the eight grays (palette settings 0,0,0; 1,1,1 etc.) to determine which print patterns are best suited for color mixing. ▶

**The excellent
graphic capabilities of
these computers would be
of very limited value
if they only took
the form of
on-screen images.**

tractor pins. Join the loop by aligning the edge of the top sheet with the taped edge of the bottom sheet. I use a simple little device made of two bulldog clips and a piece of cardboard to make this easier (see Figure 1). Align the edges carefully so they touch but don't overlap. After you have the paper positioned, tack it in place, using light pressure. If it looks good, secure the splice using firm pressure.

With the printer off use the manual feed knob to align one of the paper separations with the top of the printhead. Turn on the printer and try three successive form feeds. If the paper ends up exactly where you started, you're in great shape. The Epson form feeds are very precise, making registration a snap. Manual adjustment may be necessary if your

Black and White...

The best sequence for multi-pass printing is to work from the lightest to darkest colors. This prevents contamination of the lighter ribbons like yellow, with ink from the darker colors such as blue. Before printing with color, clean the printhead. Next, turn off the printer, remove the ribbon cartridge and pass a strip of paper or cloth between the printhead and the ribbon guide. Load the yellow ribbon and we'll be ready to start.

With the printer off, manually feed the paper to the desired starting point. Turn on the printer. Before we start printing a little trick is necessary to insure proper registration. If the TESTPRINT picture is on screen, erase it, or if you're using a program that has multiple screens, switch to a blank (white) screen. Now select Print Pic to start the printer. (Yes, I'm asking you to print a blank screen.) After a couple of passes of the printhead press [UNDO] to abort the printing process.

**If the paper
ends up exactly
where you started, you're
in great shape.**

Notice that the printhead stops in the far right position. This is where it will stop after printing each color. Now press the "on line" button once (taking the printer off line) followed by the "FF" (form feed) button. By doing this "mock" print we avoid a small register shift that occurs if we start with the printhead in the far left position it assumes on power-up. This may not be necessary for all printers and is definitely not needed if you must turn off your printer to change ribbons. *The important thing is to insure that everything is in exactly the same state prior to each pass.*

Re-select or re-load the TESTPRINT pic. The labels next to each of the boxes indicate the color mixes we're creating in this test. Y=solid yellow, y=halfone yellow, R=solid red, r=halfone red, B=solid blue, b=halfone blue. Since we are printing yellow first, fill all of the boxes containing a "Y" in their label with black using the solid fill pattern. Fill those containing "y" with the halfone grey (palette setting 3,3,3).

Now put the printer back on line (make sure that you performed a form feed after the mock print). Select PRINT PIC from the DEGAS menu. After the printer has made enough passes to print the color bar, labels, and the first of the three overlays, abort the print process. Three off-line form feeds

will bring the paper back into position for the next color (red).

Of course, three copies of this print can be made using this paper loop, but let's just make one this time. If this or any of the subsequent ribbons are weak you can reprint the image before changing ribbons. Double printing every color will produce a very vivid print.

If you're careful it's possible to change ribbons without turning off the Epson LX-80. *Do not try to move the printhead with the printer on. This will damage the printer.* Simply lift out the yellow ribbon and replace it with the red.

Repeat the steps we used to print the yellow. (There's no need to repeat the mock print.) Start by clearing the color-bar boxes (by filling with white) and filling those with "R" or "r" in their labels using solid black and grey fills respectively. Then, using the OPAQUE block mode, (BLOCK COPY in DEGAS, Blocked, Edge Stop in DEGAS Elite), move the RED OVERLAY into position exactly over the YELLOW OVERLAY eliminating the latter. I've included vertical and horizontal registration lines to aid in positioning. When defining the block clip the overlay off just below its title so that you can use the vertical registration line.

After printing the red and re-aligning the paper loop, repeat the above steps with the blue ribbon in place. Be sure to clear and refill the color-bar and replace the RED OVERLAY with the BLUE OVERLAY.

The final result should be a color bar with a full range of hues, and a rather colorful drawing. This color bar doesn't show all of the possible combinations using these three colors in two shades, let alone those possible with additional ribbons and shades. If you're feeling ambitious, you might try creating some more complex color palettes.

DESIGNING GRAPHICS FOR PRINT

Now that we have a system for printing color graphics, some general theory and methods to aid in their design are in order. The color theory applies to all types of printout. Variations of the overlay techniques can be used for special effects with screen photography.

COLOR

Some limitations are imposed by the particular pigments and hardware used to print our graphics. After all, mixing the three primary pigments (yellow, magenta, and cyan) can theoretically yield any desired hue. All of the color pictures in this magazine are composed of mixes of those three colors (plus black in some cases). So, using three color ribbons with multi-pass printing, or the three color ribbon supplied with color printers, we should be able to print any desired hue. Unfortunately, that's not the case.

The offset printing technology used to print this magazine benefits from two important advantages over most computer

printers. One is resolution. Very precise color mixes are possible because many thousands of tiny dots of varying size are combined in each square inch. The second is pigment transparency. Offset pigments are very transparent, while ribbon ink tends to be a little less so. This diminishes the influence of the underlying colors on those overprinted.

Those are fairly unavoidable shortcomings. Even 24-pin machines can't come close to the resolution of offset printing. The requirements of impact transferable inks preclude perfect transparency. In addition, good primary colors are not available for all printers. The only blue ribbon I've found for the Epson is not a true cyan. Cyan, in printing, is actually a blue-green. The blue ribbon is a bit off to the red side of the spectrum and incapable of producing certain hues when combined with other pigments.

For some printers the primaries are not available, forcing you to design graphics around palettes like blue, brown, and purple. When shopping for ribbons look for a bright yellow, true magenta, and true cyan (see *Figure 2*) for maximum color range and flexibility. Other colors are useful. For the Epson the green ribbon gets around some of the blues' failings, and the brown has good mixing potential. Whatever your printer/ribbon situation is, the trick is to learn limitations through testing and design graphics around them.

Some things, easy to create on-screen, are difficult to capture with most color printers. Pastel colors, subtle color shifts, luminous effects, and large areas of smooth color, all tend to



FIGURE 2

lose something in the translation. Faded ribbons are very handy for solving some of these problems. They work like transparent inks and can be printed as solid patterns for very smooth color mixes and subtle tints.

If you're working with a color printer, print some sample palettes comprised of small color boxes labeled with their respective RGB palette settings. You'll discover, while a few of the printed colors approximate their on-screen sources, many don't. Quite often an unexpected RGB setting will produce a desired print color. Try creating your graphics on-screen first and then change the RGB settings using the printed palette as a guide. This special print version of your drawing may have to look quite odd on-screen to produce the desired output.

OVERLAYS

If you are using the multi-pass print techniques described above you'll need to develop a good sense of color mixing as well as an understanding of the concept of color overlays. ▶

OKIMATE 20

If you want easy, inexpensive color printout capability, it's tough to top the Okimate 20 printer. At about \$220 retail (including the required "Plug 'n Print" interface package), it is widely available and can be purchased at discount and department stores for substantially less.

The Okimate 20 uses thermal transfer technology, requiring special heat sensitive ribbons. It will print on all types of paper but achieves optimal results with glossy thermal transfer paper (also commonly available and inexpensive). The three-color ribbons produce vivid full color prints with bright saturated colors. A color ribbon runs about \$5.50 and is good for 7-10 vertical (half page) printouts. It's a one-use ribbon.

The Okimate also offers excellent black and white capabilities. The black ribbon lays down a very sharp, dark, consistent image. These printouts are excellent for reproduction by photocopying or offset printing. It also prints NLQ text at 100 cps because only one pass of the printhead is required. The black ribbon is a little more expensive (\$6.00) and also good for only one-time use.

The printhead itself is a replaceable (\$20.00) dollar item. I had some bad experience with it burning out very quickly (twice), although, strangely enough, other Okimate owners I've talked to haven't had the same problem. Okidata informed me that the expected printhead life is 10 million characters, and that it is covered under the 90-day factory warranty. ■



MARY RHOMBERG LAVERY

Black and White...

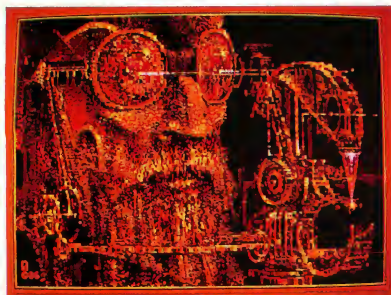
Some form of overlays or color plates are used in the production of most forms of color printing.

Creating overlays for multi-pass prints is directly analogous to techniques used by artists to produce multicolored etchings, wood-blocks, or silkscreens. One plate, block or stencil



Printed results.

is created for each color to be printed. The term overlay comes from the process of using a transparent material, laid over a master drawing, to design the individual color plates. The ability to easily make duplicates of our on-screen images aids in the creation of overlays. Similar techniques can be used to create multicolored images using a monochrome monitor and color filters when photographing the screen. (See the Screen Photography section).



Original DE GAS Elite art.

To help design the overlays the artist usually creates a color sketch. This is a rough version of what the final art will look like. There are two methods that I use to create color sketches and overlays for multi-pass prints.

METHOD ONE

The first method works best in the low resolution mode. Set your background color (far left position on the DEGAS palette) to white and place your darkest color in the far right palette position. If you can get by without it, don't use the far right color in your picture.

Creating overlays in this first method is mostly a matter of elimination. I'll use the yellow, red, and blue ribbon system as an example. With a low resolution picture as a starting point, create the yellow overlay using the following steps. Make sure you have saved your picture to disk before creating the overlays.

First, eliminate all of the colors that don't contain yellow. This includes most blues, pinks, and purples. All such colors are removed from the image by changing their palette settings to match the background color (white 7,7,7).

Next, determine how much yellow is present in each of the remaining colors. A bright fire engine red, for example, needs solid (100%) yellow; change that color's palette setting to black (0,0,0). A blue-green might need about 25% yellow, so set its palette to light grey (5,5,5). Knowing how much of each primary to include in each color mix is tricky. The surer method is to use a printed, annotated palette as a guide.

After setting all of the yellow-containing colors' grey values, save this altered image to disk. I use the last two letters of the filename to identify overlays (i.e. DUCKS_OY.P11). Now reload the original and repeat the process for each additional color you wish to print.

This is a fairly straightforward process. A clever programmer could probably write algorithms to create these overlays automatically. Doing them by hand offers the opportunity to customize them to suit the peculiarities of your printer. With some experimentation you'll learn to go beyond the mechanical interpretation of colors. Adding or subtracting pixels and creating special screens for additional colors produces enhanced results.

METHOD TWO

This method is not as simple as the first, but has the capability to produce exceptional color printouts. The sample overlays in the TESTPRNT.P12 are examples of this approach. One advantage is its use of the highest resolution available to you (medium-res with color monitors; high-res with monochrome). The sample includes only three overlays, but as many as desired can be used in the production of a single print.

The starting point is a medium or high-res 'master' pic-

ture. Copies of this picture are then changed into overlays. DEGAS Elite is an excellent tool for this process. The multiple work-screens allow simultaneous creation and comparison of the individual overlays. The CHANGE function is very valuable for altering the master drawing. The difficulty is in knowing what the overlays should look like to achieve the desired result.

A simple example may help de-mystify the procedure. Color charts or graphs can be created easily with the methods used to print the sample color-bar. In fact, any master drawing composed of outlined shapes can be transformed into overlays by simply filling those shapes with greys (or various fill patterns in monochrome). The outlines, if present in each overlay, will end up black after printing several colors.

Since the final print can contain many more colors than the chosen resolution accommodates, a separate color sketch is needed. One approach is to use a regular black and white printout of your master drawing colored with any traditional media, such as markers or colored pencils. A selection of colors that closely match your ribbons will make the sketch very useful.

Creating color prints with these methods is as much art as science. This is part of its appeal to me—it pushes the hardware beyond its expected performance. Take the time to discover the particular quirks of your printer. Anything from simple color text and graphics to full-blown fine art computer prints can be produced with the simplest hardware.

SCREEN PHOTOGRAPHY

The best way to capture the true color and feel of ST on-screen graphics is to photograph the screen. Often the screen images seen in this and other computer publications are reproduced from photographs. You can do your own screen photography with great success using relatively simple equipment.

The essential elements include a 35mm (or larger) format camera with a manually controllable shutter and aperture (lens opening), a cable release, and a tripod. It helps if the camera is a "single lens reflex" (SLR) type. This type of camera uses the same lens for viewing and placing the image on film, making it easier to accurately position the screen image on film.

The manual shutter, cable release, and tripod are necessary because of the long exposures (1-7 seconds) required. For this same reason most simple snapshot cameras, including some of the all-automatic 35mm cameras are not suitable. Slide or negative film can be used. Film speeds (ASA) in the 100-200 range seem to work well. Higher speed films, while reducing exposure times, tend to lose some of the clarity and color fidelity. The standard lens (49mm) on most quality 35mm cameras will work for full screen shots. Good close-up lenses or "macros" (not to be confused with computing

macros) will reduce distortion and allow you to photograph small sections of the screen.

SETTING UP

Find the proper distance from the screen by viewing it through the camera. Set up your tripod, taking care to adjust the height and angle of the camera perpendicular to the screen. This can be checked with SLR cameras by viewing through the lens. Make sure the edges of the screen, or those of a box drawn on the screen, are parallel to the edges of the view finder.

**Don't throw
away any ribbon,
black or color,
no matter how tired
it is.**

Screen reflections are a major concern. If possible, take the pictures in a completely darkened room. If this isn't possible, it's necessary to set up a black backdrop. A large black cloth suspended from the ceiling is a good solution. It should be placed just in front of the camera and have a small hole through which the lens is inserted.

Exposures are based on three factors: shutter speed, aperture (the size of the lens opening), and film speed (sensitivity to light). I prefer an aperture (often referred to as the "f-stop") of f8. Wider lens openings (lower f-stop number) increase distortion and make focusing more critical. Higher f-stops require very long exposures. In photography "bracketing" refers to taking a range of exposures to test for the optimal one. Always bracket your shots when photographing the screen. Prior to any serious photo sessions shoot a couple of widely bracketed test rolls to find the best range of exposures.

Most built-in light meters are incapable of giving readings for the long exposures we're using. If you have a separate light meter you should be able to get some idea of exposure settings. Hold the meter close to a screen filled with a medium grey (3.3,3 or 4.4,4 palette settings with a color monitor, or a 50% fill with monochrome). This gives you an average reading. Actual exposures will vary depending on the overall darkness or lightness of the image you're photographing. If you are unable to get a meter reading, the following chart will help you get started. ▶

Black and White...

FILM SPEED (ASA)	F-STOP	EXPOSURE TIME
64	8	2-7 seconds
100	8	1-4 seconds
200	8	1/2-2 seconds

These exposures are based on tests done with Ektachrome slide film. Other films may vary. The times represent a range for bracketing. As a general rule the more white or light color a particular image contains, the shorter the exposure.

SHOOTING

Set the monitor's brightness control to its halfway, notched position. This is a good brightness for photography and assures consistency from one shoot to the next. Check carefully for screen reflections. (This is best done with a black screen.) If the camera is properly aligned, film loaded, aperture & ASA set, and shutter set to manual, you're ready to shoot.

Since most cameras don't have shutter speeds greater than one second, some form of timing is needed. A friend pointed out to me that an audible source works best. Try a watch or clock that ticks, or a metronome. Some manual shutters must be held open for the duration of the exposure, while others require one push to open and a second push to close. Check your camera's manual and synchronize your clicks with the audible timer.

Bracket the exposures and keep careful notes with the pictures title, frame number, and exposure/film information. Large changes in exposure times are required to show significant differences on film.

SPECIAL EFFECTS

Screen photography opens up the entire world of photographic effects. Double exposures can be used to fuse computer graphics with other artforms, real-life images, or other computer images. Time exposures can capture the movement of on-screen animation. Special filters, lenses, and processing techniques add a new dimension to ST graphics. Perhaps in a future article I'll explore some special effects in greater detail. For now here are a couple of ideas.

By using color filters, you can transform monochrome images into color photographs. A series of overlays, photographed through color filters onto one piece of film can produce multicolored, high-resolution images. The color theory is different because we are mixing light. We divide shutter times so that several exposures can be combined.

Transparent images such as film negatives/positives or photocopies on acetate can be placed in front of the screen, colored in using a paint program, then photographed as a unit. This creates an interesting effect that transcends the resolution limitations of the screen.

These effects require a fair knowledge of photography and

a good amount of experimentation to perfect. Simple screen shots however, are quite easy. Experiment and keep good records of your tests. The results are worth the effort. All of the rich color and luminous qualities of your ST graphics can be captured with photography.

THIRD GENERATION

The computer is just one of many tools that can be used to produce graphics. When combined with other media or manipulated by other devices, these graphics enter a new dimension. The methods I've described provide a hard-copy bridge between computer graphics and other art forms.

Try experimenting with your photos and printouts. Your local copy shop is a good place to start. Modern electrostatic

**Creating
overlays for multi-pass
prints is directly
analogous to techniques
used to produce multicolored
etchings, wood-blocks, or
silkscreens.**

copiers have the ability to enlarge, reduce, color and copy your graphics onto a variety of materials. This is especially valuable if you wish to alter or enhance your work with traditional media. Photo labs also offer a number of options. See the REFERENCE section for the name of one mail order lab that offers some interesting services, including huge enlargements at relatively modest prices.

Also included in the REFERENCE section is the address of a place that does laser transfer images of computer graphics (ie the March 1986 ANTIC fractal cover). This is not an inexpensive service but it offers impressive results.

That's it for now. So crack your knuckles, grab a fresh ribbon, fire up your printer, and let the glories of color computer graphics wash over you. ■

REFERENCE

PRINTER DRIVERS

- *Stealing The ST Printer Driver* by Tom Hudson START #1 Summer 1986 pp. 20-27

- *Printer Drivers The Easy Way* by Tom Hudson START #4 Spring 1987
- Compuserve SIG Atari 16

COLOR RIBBONS

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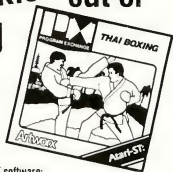
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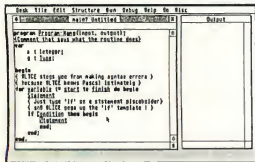
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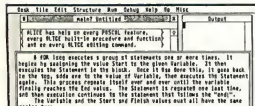
We were going to tell you all about



but we'd rather show you . . .



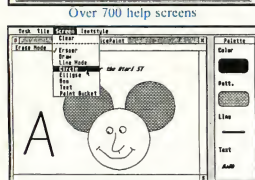
Your program from "templates"



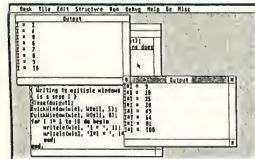
Multiple window editing

Programming Made Easy

If you're into programming, or if you want to be, you won't find a better system for your Atari ST than ALICE: The Personal Pascal. Already popular on the IBM-PC, ALICE now brings easy, interactive programming to the Atari ST.



Free paint program with source



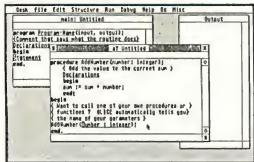
Your programs can do windows!



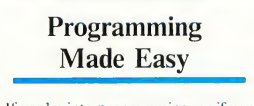
Powerful variable trace

"If I needed to learn Pascal all over again, or were going to teach a course in the language, I can't imagine using any program other than ALICE."

— Adam Green, Infoworld

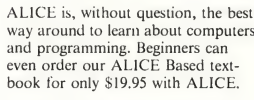


Breakpoints, Single Step



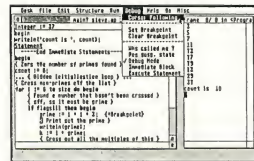
"ALICE may be the most advanced programming environment currently available for the PC."

— Michael Covington, PC World



Easy graphics in windows

Even if you're an expert, ALICE makes it easier to write, test and especially debug programs. ALICE's extensive Pascal improvements include a GEM interface even beginners can use and most of the extensions of Turbo Pascal. The surrounding examples just give a glimpse at how easy it is to put programs together using ALICE.



Simple menus and events

"If you enjoy programming languages, this comes pretty darn close to being as much fun as a video game."

— Gene Wilburn, Computing Canada

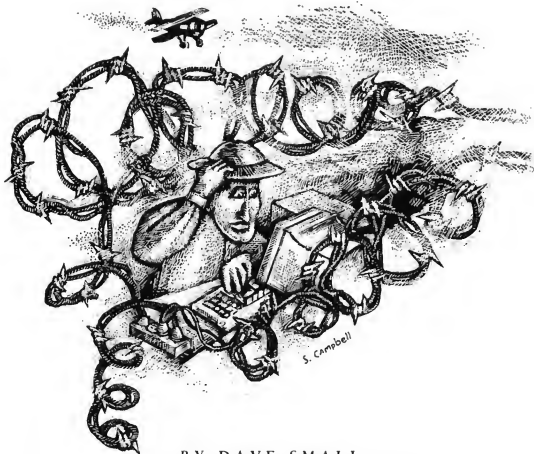
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Hard Disk Warfare

Experience from the trenches



BY DAVE SMALL
CONTRIBUTING EDITOR
PROGRAMS BY DAN MOORE AND DAVE SMALL

Straight from the hacker front line, soldiers Moore and Small tell terrible tales of survival and offer a bag of tricks the likes of a Swiss army knife: The Twister floppy fast-formatter, the Meg-A-Minute hard disk backup, the hard disk write-protector, the Reboot, and the famed Reviver. Required reading for all hard disk owners, plus some nifty gadgets for floppy users, too. Look inside the DISK.ST folder on your START Disk.

 Folder DISK.ST
on your START disk

Warfare...

After the exciting experience of crashing three hard disks in a week's time, Dan Moore and I decided it was time to write a hard disk backup utility. (Contributing to the decision was the fact that another hard disk backup utility was responsible for a crash.) Then, we needed a hard disk write protector because the programs we were developing had a tendency to delete files for no given reason. Then we needed a disk checker, and a fast formatter, and a . . . well, you get the idea.

This is generally how articles like this come to be written: experience from the trenches. My articles on 68901 and 68000 interrupts (Antic: May, June, and July 1986) came from researching them for the Macintosh emulator cartridge. My floppy disk article ("Probing the FDC") came mostly from the disk drivers from same (START #2). And Dan Moore and I built "The Amazing MouseTrap" while testing Dan's Paperclip Elite program (START #2).

Dan and I get asked a lot why we write these articles. A typical question might be, "Do you write these articles because of the hacker ethic, the freedom of information exchange so vital to the microcomputer revolution?"

To which we usually answer, "No, we're just showing off."

If you'll dig into this article, you'll find some really useful stuff:

The Twister: a new disk formatter which doubles your floppy disk speed and increases their storage capacity by over 10 percent. We know, there's been some competition in this field, but the Twister is the best, for reasons I'll explain in the article. It will also give you some background on floppy disks we haven't covered before.

The Rebooter: an extremely helpful little AUTO folder routine that forces a complete reboot anytime you press RESET. You want this unless you're really into very strange computer errors. It also shuts off write-verify on the disk, which doubles your disk writing speed with no effective loss.

Hard Disk Write Protector: a very handy little desk accessory utility. It prevents any program from accidentally writing on the hard disk. Great for debugging programs without trashing your hard disk.

The Hard Disk Reviver: users of the automatic hard disk boot routines are going to get in real trouble if anything ever goes wrong with the automatic boot (for instance, the driver file in directory C: goes bad). You literally can't start up the ST with the hard disk attached. You're stuck unless you have the Reviver, which lets you bypass the hard disk automatic boot and (at least) gets you on your way to fixing the problem.

The Meg-A-Minute backup utility: the fastest hard disk backup you'll find for your ST. Does what its name says. It backs up a megabyte per minute. Since most ST programmers seem to use 5 megabyte partitions to maintain hard disk speed, we're only talking 5 minutes for a complete backup.

There's also some nifty information here about the partition sector you'll want to know.

THE TWISTER

The Twister isn't really a hard disk utility, it's a program which doubles your floppy disk speed and adds an additional 40K per disk side. It formats a disk in a special manner, letting the disk drivers run at full speed instead of the normal half speed. The new format is completely compatible with your ST's operating system.

USING TWISTER

Twister is quite simple to use. Double-click on TWISTERTOS. It will ask you which drive you want to format and whether you want double-sided disks or not. It will then go off and do its thing, formatting and verifying the disk, initializing the disk directory and boot block as necessary. You might want to write-protect your TWISTER disk just in case you get out of sync with the messages and accidentally try to format it.

HOW TWISTER WORKS

To understand Twister, you need to understand sector skew and the dynamics of sector reading. So, let's dig into that first.

First, if you haven't already, go pick up the second issue of START and read the floppy disk article within. It covers lots of gruesome basics about floppy disks that there isn't room to repeat here, and also gives you a listing of the source code to Atari's floppy disk drivers.

MORE DATA PER DOLLAR

A typical single-sided ST disk is divided into 80 concentric rings called *tracks*, and each track has nine 512-byte sectors laid out on it. The sectors are numbered one through nine and are laid out like this: 1-2-3-4-5-6-7-8-9. The beginning (and end) of a track are marked by the *index pulse*, generated once per revolution by the floppy hardware. The disk is spinning five times per second, which means 1/5 second, or .2 seconds, per spin. In milliseconds (1/1000ths of a second), that's 200 ms.

The floppy hardware sector takes 16.6 ms to read a sector, with around 3-4 microseconds of "dead space" between sectors. If there's 20 ms per sector, and 200 ms per spin, and hence, then quick math should show room for 10 sectors per track even though a normal format only uses nine. We picked up on this and added an extra sector per track. We just put it after the last sector and told the operating system there are now 10 sectors per track instead of 9. That's an extra 40K per disk side, or 80K on the increasingly popular double-sided drive. The disk sectors are numbered:

1-2-3-4-5-6-7-8-9-10.

Is there room for an 11th sector? The only way might be to

cram several sectors together so there's no "dead space" between them, but that's a fairly complicated problem (called *blocking/deblocking*). We wouldn't gain that much room, anyway, so let's not bother. Let me leave you from these paragraphs with the image of the disk that looks like this: (index pulse) 1-2-4-5-6-7-8-9-10 (index pulse) 1-2-3-4-5-6-7-8-9-10 (index pulse), repeating forever

A SNAGGED READ REQUEST

The low-level TOS routine which does disk input is called `_flopdr` (floppy read). One nice feature of `_flopdr` is that it is very fast. It can read an entire track in just one spin; in other words, it can handle the overhead of doing requests for 9 sectors, reading them in, and cleaning up after the floppy controller. This is necessary because we're dealing with floppy media. We cannot get to the whole track at once; each sector must rotate underneath the stationary disk head. The floppy read/write head sits on a given track in the same place and

Sector 1

marches around the
disk with a 2-sector
offset; hence the name
"Twister."

must wait for the data coming underneath the head to spin by; if we want sector 1, and sector 1 is currently half a spin away, we must wait 100 milliseconds for it to come around again and be read in.

When the higher level I/O routine `Rwabs` (read/write absolute) tells `_flopdr` to read in 9 sectors on track #0, `_flopdr` waits for sector #1 to spin around (which takes an unknown length of time, depending on where it was when we started), then reads, very quickly, 1-2-3-4-5-6-7-8-9. That's 9 sectors, one complete track. The disk has rotated just past sector number 9; it's not even at the end of the track (the index pulse) quite yet. `_flopdr` returns to `Rwabs`. `Rwabs` then figures out it's at the end of the current track. So it rings up `_flopdr` again and asks for the next track.

Unfortunately, there's a problem here. `_flopdr` needs to move the disk read/write head to the next track. It does so, but, the "seek" routine that moves the head refuses to give control back to `_flopdr` until it verifies it's on the right track.

This is what messes everything up. Why? `Seek` does this verification by reading in an *address mark*, or *sector header* and looking for the proper track number. Moving the head takes about 2 milliseconds, and, at this point, the disk has rotated to right around the index pulse, well before sector 1.

The head settles down on the track, and `Seek` begins looking for a sector header. Well, of course, it finds sector #1's header, complete with a "track #" mark. `Seek` then returns to `_flopdr`, which then issues a request for sector #1. But sector #1 just spun by—`Seek` "used it up." Hence, `_flopdr` has to wait an *entire spin* for sector #1 to spin by again. Then, it reads, quickly, 1-2-3-4-5-6-7-8-9, returns to `Rwabs`, and everything continues. We thus miss sector #1 every time we step to a new track, thereby adding 1/5 of a second per track overhead to all floppy read/writes. Now, how can we cure this problem?

NO CAN DO

We can't recode the floppy BIOS to remove the seek-with-verify causing this problem. There's just too much code there. Nor can we modify that code directly, since it's in ROM. (Note: Some people with EPROM burners have done just this and ended up trashing disks. Look under "head settling time" to find out why.) We can't very easily recode just the `SEEK` routine because, again, it's tied into the floppy BIOS routines so intimately.

Well, if we can't change the system software, let's change the disk.

EX-SKEWS ME

Let's lay out the track a bit differently and watch the effect. The first change will be 10 sectors per track, which we've already covered. The second change will be the sector ordering.

All tracks, as usual, begin and end with the index pulse.

Track 0: 1,2,3,4,5,6,7,8,9,10

Track 1: 9,10,1,2,3,4,5,6,7,8

Track 2: 7,8,9,10,1,2,3,4,5,6

Track 3: 5,6,7,8,9,10,1,2,3,4

Track 4: 3,4,5,6,7,8,9,10,1,2

Track 5: 1,2,3,4,5,6,7,8,9,10 (which is the same as #0)

THE PATTERN THEN REPEATS.

At first, this renumbering looks mindless. But there's a good reason for it. Let's look at a read request with our new format. Suppose we start at track #0.

When `_flopdr` attempts to read the track, it waits for sector #1 to spin by, fetches it, then it rapidly gets 2-3-4-5-6-7-8-9-10 as they pass under the read/write head. At the end of this sequence, the floppy diskette is just past the end of sector #10, near the end of the track.

If `Rwabs` needs more data, it calls on `_flopdr` again. `_flopdr` rings up `Seek`, which moves the head to track #1, and ▶

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begins hunting a sector mark. It finds sector #9 (look at the map), which is the first *physical* sector on the track, complete with the proper track number, and returns to `_flopdr`, which then requests sector #1. Sector #9 spins by, followed by sector #10; then sector #1 is found. `_flopdr` then reads 1-2-3-4-5-6-7-8, sees an index pulse, then reads 9-10, and returns to `_Rwabs`. At this point, the diskette is just past sector #10 on track 1. Notice we've eliminated the "seek snag" between these two tracks, but let's see what happens on the next track.

`Rwabs` calls up `_flopdr` again to read in track 2. `_flopdr` does a seek, which gets verified by sector #9 and #10 on track #3. Then, it reads in 1-10, returns to `Rwabs`, and so on.

The net result is we're not dropping spins anymore; we're grabbing the sector data as fast as it spins by under the disk head. This is the essential element of Twister. Note how sector 1 marches around the disk with a 2-sector offset; hence the name "Twister."

BUT DOES IT REALLY WORK?

Actual benchmarking indicates Twister does exactly what it's supposed to do; it can read in an entire disk side (80 tracks) in 80 spins, plus about ten for overhead, or 18 seconds. A double-sided disk takes one more spin for the back side of each track, or 36 seconds. This is very good performance relative to anyone's personal computer. You just can't get data to or from the floppy disk any faster than this; it isn't physically possible at 300 RPM. Believe me, it outruns any other personal computer floppy driver I've seen. Put your hand on the disk drive, and you'll feel it stepping five times per second.

THE DREADED HEAD RATTLE

Some people have realized just what I've been talking about here and solved the problem by changing `Seek`, using an EPROM burner and modifying the operating system ROMs. The problem here is that a seek takes a little while. First, the head has to move to the new track. This takes about 2 milliseconds. Then, the head rattles around ("settling") for about 30 milliseconds before it settles down enough to be reliable—it literally rattles back and forth from the sharp acceleration of the step. If we seek to the new track on a 10-sector disk, going from sector 10 of the previous track to sector 1 of the new track, we have about 10 milliseconds, maximum, of head settling time before sector 1 spins by. The reality is you'll miss sector 1 about half the time because the head hasn't stopped rattling; go ahead and try if you like.

The situation is better with 9-sector disks because there's about 20 milliseconds of "dead" area at the end of each track (where we put sector #10). Generally this works out okay, but it's possible to start writing before the head has settled and thus write in a zig-zag pattern across a track before finally settling down—leaving a skid mark with sector one across the

entire track. The next time you try to read that sector #1, you'll find it's unreadable. Anyway, having destroyed several disks with this technique (if you're curious, with the Motivator-Write option of the Magic Sac), I have since learned to let the head settle. Hence, instead of 1 sector (16.6 milliseconds) of head-settling time, I give `SEEK` two sectors (33 milliseconds) to quit rattling and catch a sector ID mark before sector #1 shows up again.

TRACK-PACKING (EXTRA ID MARKS)

An alternate method of fooling `Seek` is to stick several sector headers at the end of each track and pray that by the time the `Seek` is done and looking for a sector header with a track #, it will find these sector headers. In other words, if we step from track 0 to 1, we'll land on the very end of track 1, pick up a sector mark to satisfy `Seek`, and get back in time to see sector

**Put your hand
on the disk drive, and
you'll feel it stepping five
times per second.**

#1. The above discussion of head rattling ought to tell you why this isn't such a good idea. You miss a great deal of the time, especially on some brands of disk drives that step slowly or rattle. If you go 9-sectors per track, it works much better, but then you've lost 40K per disk side.

SIDE TO SIDE

If we use double sided disks, we also have to twist the sector data from side to side. I don't really know why; there should not be that much overhead in switching sides. However, there seems to be.

DISK COPY OVERHEAD

Generally, using Twister, you'll find TOS doesn't get in the way. It requests big blocks of data, then steps back while `Rwabs` and `_flopdr` handle the work. However, one routine in particular is very slow: disk copy. (This is when you drag a disk icon to another disk icon, and the Desktop copies all the tracks of one disk to another.) You'll find there is so much overhead going from track to track that sector #1 gets missed, even with the added safety margin I've put in. The problem is most likely the screen animation; while the Desktop is draw- ▶

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ing pretty graphics, sector #1 is spinning by. Since I don't want to slow down sector I/O for one special case, I've left this alone; it runs just as slowly as regular floppies and there's little I can do about it.

DAVE'S WRITE-WITH-VERIFY LECTURE

Another problem you're going to see is write-verify. For some reason I have yet to fathom, the Atari **Rwabs** insists on reading back sectors that have just been written to ensure that data was *really* written. I don't know why. At first it seems logical and cautious. You know instantly if something has gone wrong: "The disk can't be written to." But think about it some more. In order for a write to take place, the disk has to be spinning and working very well. The floppy controller must see a valid sector mark for the sector to be written, and the write protect switch must be off. The controller then writes 166 milliseconds worth of data, during which time the disk has to work. It even writes a CRC so next time you read the sector you know all is well with it. Why re-read it at write time? Odds are you're not going to be able to swap to a new disk if it screws up anyway. All you're managing to do is slow down disk operation while checking for an incredibly unlikely error. Anyway, doing a read after a write will of course foul up the speed of said write operations. If this doesn't turn you on, then turn off the write-verify by writing a \$0 (word) to location \$444. I have this done automatically with the Rebooter routine included in this package.

At first it might seem incautious not to read back everything you write to the disk for verification. But then again, I've known people who put up with this write-verify nonsense on the 8-bit Ataris (with much less reliable hardware) for five years and never once got a "write didn't work out" error. As the guy who wrote Atari DOS (Bill Wilkinson) once told me, "It's an enormous waste of time. I never do it." Bill and I don't agree on much (look, he wrote a Pascal for the ST), but this one we agree on.

THE REBOOTER

The Rebooter is included here because it has a side effect of turning off write-verify, which I talk about above. It has a rather nice main feature, however; it forces a complete reboot anytime you press RESET.

At first, this might seem silly. RESET is RESET. But it really isn't, unfortunately.

There are essentially two kinds of system startups. The first is a *coldstart*, where memory is cleared and the system initialized, generally brought up completely from scratch. Then, there is a *warmstart*, which happens anytime you press RESET. With a warmstart, a lot of tables and such set up by a coldstart are not changed. The system distinguishes between a coldstart and warmstart by a flag (well, actually, several) called MEMVALID, located at \$420.

Now a warmstart is fine for switching monitor resolutions (which is probably the reason for this design), but the fact is, the RESET switch often does not restore a machine to life. If any of those low memory tables which warmstart leaves alone are damaged (easy to do when developing software), a warmstart will leave them damaged. Another problem is programs which require a coldstart to load properly, such as RAMdisks, are also reloaded by a warmstart. Typically the same RAMDISK will reload twice, occupying a big chunk of memory and screwing up the computer. Because of these problems, most developers have learned that a warmstart is a bad idea. Instead, they force a coldstart. They switch the power off, then on, to restart the machine.

**It's possible
to start writing
before the head has
settled—leaving a skid
mark with sector one across
the entire track.**

But, there are two problems here: 1.) Memory takes around 2-3 seconds after poweroff to decay enough for the ST to realize it is being coldstarted because of the power supply design (which keeps the RAMs alive that long). I have 1040's which take *fifteen seconds* to realize they're shut off. (Now there's a computer with determination!) and, 2.) It is generally hard on computers to switch them off and on, which subjects the internal parts to stress.

I have a solution to this problem which I call the Rebooter. It sets up low memory in the ST so that a press of the RESET switch causes a true coldstart. The program is loaded from an AUTO folder, and is run during bootup. It clears MEMVALID (\$420), which is used as a flag during RESET to determine coldstart/warmstart (among other things). Because this flag is cleared, the next time the ST is RESET, it will do a complete coldstart, zeroing out memory, and so forth. Added to scenic Rebooter is a clear of location \$444, the write-verify flag, so we take care of lots of little busy details and fixes at once.

The source code demonstrates a simple assembly language "shell" for writing your own assembly code and getting it to run, including the infamous "release memory" application

startup kludge. It also shows how to switch to supervisor mode to access low memory. These routines are useful in many applications. If you want to try your hand at 68000, this is a great place to start. To use REBOOT.PRG, just move it to your AUTO folder and boot up with it. When you press the RESET switch, the machine will coldstart. (Warning: if you name it REBOOT.TOS, it won't run; only .PRG programs are run in the AUTO folder.) REBOOT.PRG ought to help you out with your RESET switch, plus it speeds up your writes. However, we offer a warranty on the first 100 disk spins or 10,000 machine cycles, whichever comes first, if it should ever fail.

HARD DISK WRITE PROTECT

Now that we've worked on the floppy disk awhile, let's move to the hard disk for a bit.

First, let's take a brief look at **Rwabs**.

Rwabs is the place where all disk accesses go. It's the moral equivalent of DSVINV/SIOV on the 8-bit machines; if you want something done to the disk, you call up **Rwabs**. All the GEM Desktop really does is translate your mouse moves and button presses into things for **Rwabs** to do.

Floppy disk, RAMdisk, and hard disk accesses all go through **Rwabs**. If GEMDOS, TOS, or any old user program wants something done to the disk, "Ask **Rwabs**. It eats anything"

If it's for a RAMdisk, send it to a RAMdisk handler. If it's for a hard disk, send to a hard disk handler. Not either of those? Okay, well, it must be for a floppy; send it to `_flopdr` (for a read) or `_flopwr` (for a write).

Now, **Rwabs** out of the box doesn't know about RAMdisks or hard disks, only floppies. You must "steal" the **Rwabs** routine, which was made easy to do, just for that purpose, and put in your own RAMdisk, hard disk, or whatever handler. Generally, such a handler will look for a given drive number (like, C:-F: for a hard disk) and handle a request if it's appropriate, otherwise, it'll return to **Rwabs**.

Now, let's come to a not-uncommon-enough situation among developers: We're testing a program (let's say, "Paperclip Delete"), and specifically its disk routine. We run the program off the hard disk and find a few seconds later it has mangled that same hard disk beyond repair. Look, it's easy to do. This fun event has happened to lots of people. And, because backing up the hard disk is such an incredibly slow process, most people don't keep complete backups.

Your alternative is to reformat and start over. Dan's hard disk write protect is to a hard disk what a write protect tab is to a floppy. It write protects the hard disk. Simple and easy; it steals away **Rwabs**, looks to see if a write is occurring to a protected hard disk and, if so, shuts it off. Since nearly all

hard disk accesses go through **Rwabs**, it should catch most, if not all, of these unexpected little surprises. Using the write protector is easy. It's a desk accessory; put it on your boot disk or the root directory of your hard disk with an .ACC extender. It gets loaded at boot time. When you want to write protect your disk, select the Protector from the Desk menu on your Desktop. Then select a given disk and protect or unprotect it.

HARD DISK REVIVAL

I installed Atari's automatic hard disk booter some time ago. It's a neat little program; on startup, the system boots automatically from the hard disk, no floppy required. It does this by placing a short boot program into the *boot sector* (the first sector) of the hard disk and has a driver program, SH204DVR.SYS, which goes on the C: directory. This works as follows: During system startup, the floppy's boot sector is read in and tested. If it's marked "bootable" (which few to none are anymore, that being a relic of TOS-in-RAM days), it is executed. Otherwise, the first sector of the hard disk is read in and checked; if it is marked executable, it's run. That normally isn't so, unless you've run the automatic booter. If you have, the hard disk boot sector reads in and installs SH204DVR.SYS. If you haven't, the system waits for floppy A: to have something (or eventually times out).

Just the other day, I tried out a friend's hard disk backup program, OSCAR, on my 5 megabyte C: partition. OSCAR proceeded to dump out my hard disk to floppy, as it should have done. It also then deleted every file on drive C:, which to be charitable, it should not have done. This was a big surprise, seeing as how I was due to ship the next revision of Magic Sac software that day. (Discerning readers will note the mini-review of OSCAR.) A strange thing happened. I couldn't turn on my ST with the hard disk connected. When I tried, I could see the hard disk "blip" on the boot sector, try to read SH204DVR.SYS (which, of course, had been deleted), and, gasp, crash when it couldn't find it.

Catch-22! I couldn't start the ST to fix the hard disk because the hard disk was zapped. Nor could I turn on the hard disk with the ST connected because that crashes the ST. (Supra users note: you can do that to a Supra but not to an Atari, in case you're wondering.) Nor can you plug in the hard disk after turning on the ST because that's a wonderful way to fry the driver chips, and, the SCSI controller does not RESET until the ST forces a RESET (on powerup). You end up with a hung controller. I cried help and called the Dan Moore Hotline for Destitute Hard Disks. As usual, I got the answering machine; I left my plea. Dan got back to me, and we spent the next twelve hours trying to cure the HD, finally involving ▶

Warfare...

CompuServe, Supra, and a sacrificial ritual, too savage to be detailed, involving a poodle, a pentagram, and the Egyptian Book of the Dead.

Anyway, here's what we found. Hard disks are laid out as any number of 512-byte sectors. For instance, a 20 megabyte hard disk (a very common size) has about 40,000 512-byte sectors. They're numbered starting at 1 up to whatever (my new 40mb drive has 80,000 sectors). To access the hard disk, you pass the sector number to **Rwabs**, which in turn invokes the hard disk driver.

SLOW TURN AHEAD

As a side note: Hard disks have a common malady: the more you put on them, the more they slow down. This is a problem in TOS and one not easily solved, or there'd be an article by us telling you how. How much does it slow down? A nearly empty hard disk can duplicate a 200K file in 6.3 seconds; a nearly full hard disk takes over 60 seconds. That's ten times slower. (Atari claims a rewrite of this stuff is in the works.) A partial solution is to *partition* the hard disk. This makes one huge hard disk into many small hard disks. Since each small hard disk has less data, operations on them run quicker. It also makes it easier for users; the partitions serve as a sort of super-folder to keep things together. For instance, my C: partition is Megamax C language stuff, D: is Alcyon "C", E: is Magic Sac, and F: is backups. C: and D: each are 5 mbytes, E: and F: are each 15 mbytes. GEMDOS supports up to 4 partitions and generally people use all of them. Again, generally you'll find C:-F: being the hard disk (and G: being a RAMdisk).

PARTITION VOLITION

The partition information is kept in a table in the first sector of the hard disk. Let's say we have a 20 mbyte drive split up into four 5 mbyte drives; GEMDOS keeps a table of the 40,000 sectors on the hard disk, saying,

Drive C: is sectors 1-9999

Drive D: is sectors 10,000-19,999

Drive E: is sectors 20,000-29,999

Drive F: is sectors 30,000-39,999.

All these drives are the same *physical* drive; they are only split up into different *logical* drives. For instance, if GEMDOS wants sectors #3-7 of drive E., **Rwabs** will handle returning actual physical sectors #20,000+3 to 20,000+7 of the hard disk. There's a bit more interesting information in the partition sector, such as total drive size, whether or not a partition is a TOS partition (I don't know of any other uses at the moment, although a Magic Sac partition is a possibility), and some optional boot code, as described above. Check out the Hitchhiker's Guide to the BIOS if you need the complete low-down on the partition sector.

Well, we finally managed to get the hard disk running by

(of all things) taking the drive apart, switching off the drive mechanism select, booting the ST, then switching the drive select back on. (These are switches on the actual mechanism, not the power switch). The hard disk drivers absolutely would not install, so we went to low-level routines to look-see the hard disk and find out what had happened. Supra Corp. had been kind enough to post low-level drivers on CompuServe; we used those and eventually got the first sector to read in. These drivers do basic sector level read-write to the hard disk, bypassing **Rwabs**. Anyway, we finally got the hard disk autoboot turned off (by screwing up the boot sector's CRC) and did some repair work. I'd like to save you the effort of opening up your drive if you get stuck in this situation. As more and more people use the automatic booter, they're going to get stuck more and more often.

REVIVE.PRG is based on a program I did quite some time ago which made double sided disks bootable by RAM TOS. (DBLBOOT.PRG—in various public domain libraries). Anyway, the Reviver reads in a floppy boot sector; prototypes it, then writes it out to a blank disk. This boot sector's only purpose in life is to abort the hard disk startup; it bypasses it early in the machine's life. You then get your normal GEM desktop and can run some low level routines to find out what happened to your disk. (The first, of course, is to try running the hard disk boot software directly and installing the drive to see if that cures the problem).

To run REVIVE.PRG—and you'll only need to do this if you do the dreaded hard drive lock up described:

1. Turn off your hard disk so you can boot.
2. Format up a blank floppy. Single sided, please.
3. Put in a disk with REVIVE.PRG. Run REVIVE.PRG. It will ask you to swap disks in A and press the SHIFT key; do so.
4. It will then write an executable boot sector out to drive A:.
5. Turn your ST off.
6. Turn your hard drive on.
7. Turn your ST on. It will boot off A: almost instantly and ignore the hard disk. From here you can do all your usual things, such as installing the hard disk driver. Atari hard drive owners who use Supra software (most common) should use the ATARIHD (Atari's) program, *not* the SUPBOOT program; SUPBOOT gets tripped up by the autoboot mechanism. This turned out to be the second reason my drive was frozen. This is a good program to have around if you have a hard disk; you may only need it once, but if you need it, you'll *really* need it. Users of the Meg-A-Minute backup program will note you can use that program to restore the partition sector and also the whole hard disk after you've booted up using the Reviver. You could, for instance, take a completely new hard disk, format it, and restore it to where any Meg-A-Minute backup was. ▶

New for 1987

MichTron announces eight new products for your Atari ST.



TRIMbase

IBM Ascend Platform
Database System
IBM DB/2

TRIMbase

Relational Data Management System

Get organized with this powerful database system. Enter names, addresses, personal or business details, collection descriptions--whatever you need, and get neat, customized reports in return. *TRIMbase* provides special relational functions for cross-file interactions: condense, break up, merge, subtract, and even join files. Pull-down menus and mouse control to make it all easy. *TRIMbase* can even exchange its data with other applications software.

Color or Monochrome \$99.95



Super Conductor

MIDI/Atari Music Development Program

This advanced program is for amateur and professional musicians alike. You can record, edit, and play back music through your Atari ST or MIDI synthesizer. *Super Conductor* holds up to 10 songs in memory for editing or performing, and special song structuring lets you repeat parts of songs, and duplicate even-measure pieces easily. Other features include complete control of external synthesizer, editing recorded material, and quantizing (corrects and aligns notes).

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Warfare...

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This is probably the fastest floppy backup program ever written for a personal computer. (And not just a personal computer with the word "Atari" on it.)

We're not being our usual modest selves. The only competition I've ever seen for it, in terms of speed, is IBM's FastBack program, which currently dominates the IBM floppy backup market. Anyway, it's a safe claim: you cannot physically write data to floppy any faster than we are doing it. It backs up more than a megabyte a minute. If you use 5 mbyte partitions, very popular in the Atari world, you can drop the whole partition to floppy in less than five minutes. This makes morning/evening backups a very attractive proposition. You don't have to wait around all afternoon to do a backup, which seems to be the speed of other currently available hard disk backup/restore routines—I've used most of them. Once.

Now, to be sure, you don't get something for nothing. We don't do a selective file backup; GEMDOS is way too slow to keep up with us at the speed we're going. We just back up everything; at this speed, why be selective about it? You also get a *complete* image of the disk, not just a motley collection of files. So be forewarned. You can't read the disk we produce with normal programs, either. Finally, we keep a copy of the partition sector, and give the option of restoring that. This generally lets you recover a completely scorched hard disk; from zilch to where you had it—including the partition sector you usually can't fix. It also lets you move megabytes of data between hard disks very, very quickly.

In short, it's just a completely dynamite backup utility.

Well, on to the program. You'll recall I said a hard disk is a large collection of 512-byte sectors. All our backup program does is take these sectors and drop them to floppy as quickly as possible. Naturally, your floppy disks must be formatted using Twister techniques (Not using Twister itself, for reasons I will mention shortly), which boosts their speed to the maximum. We drop the hard disk image to floppy one floppy-sized chunk at a time; this is called *imaging* the hard disk. If we were writing this in BASIC, it would look something like this:

```
FOR SECTOR=1 TO 10,000 STEP 800
```

```
(Write: Sector to Sector +799)
```

```
NEXT SECTOR
```

Get the idea?

The program in reality uses a 100K memory buffer because the hard disk routines die if they attempt to transfer more than 128K. (That was a fun one to debug.) We write 10 sector tracks, 80 per side, or 800 sectors per side. If you go

double sided, that's 1600 sectors per disk. Thus, for single sided, we get 400K per disk; for double sided, we get 800K per disk. The actual write time is 18 seconds for single sided disks, and 36 seconds for double sided disks. Add a few seconds for speed stabilizing and disk switching, and you still have 800K in 45 seconds—a transfer rate of well over a megabyte per minute. This is even quicker than some of the tape backup systems out for other machines. Incidentally, many tape backup units use floppy controller chips for reading and writing, and we're just exactly as fast as they are for that reason.

The backup program, when run, presents you with a first menu, which asks you if you're backing up or restoring a hard disk. If backing up, you're then presented with a menu of the various drive partitions—at what sector they begin and how large they are. You can back up any of them; the menu will tell you how many floppies you'll need. You'll also need to specify single- or double-sided floppy disks. The backup program tells you to switch disks as necessary. When done, it exits pleasantly through the first menu. When restoring, things are a bit trickier. The simplest restore is just a plain restore and will serve most intents and purposes. Be forewarned: you're not allowed to restore a partition which has less physical sectors than the one you backed up (like trying to back up a 10 mbyte partition into a 5 mbyte partition). You *can*, however, do a restore into a bigger partition, but the excess space will be essentially unusable. That's up to you.

The other option allows you to restore the partition sector. But be careful. You can nuke your hard disk. We give you a no-holds-barred ability to do that (with a chance to cop-out, though). If you *change* the partition data by restoring it, you'll completely destroy any other data on the hard disk.

When restore gets rolling, it again asks you to put in the proper disk number, and images that off to the hard disk. It's smart enough to know if you mess up the disk swapping as well. When restore is finished, it asks you to reboot the machine. We don't do this because we're lazy; GEMDOS has a thing about never re-logging a hard disk directory because it isn't "changeable media." It's easiest to just reboot. (Also, if you've changed the partition sector, you will *want* to reboot, believe me. If you don't, you'll damage the restored version if you do any disk writes at all.)

Typically, we would recommend doing a complete image of your hard disk, then doing a daily backup of whatever partition you use most. If you're doing something with the potential to butcher the hard disk, then do a backup beforehand. Five minutes is pretty reasonable insurance compared to a complete hard disk rebuild. You'll need about one and a quarter floppies per megabyte, assuming a double sided drive (which really helps, otherwise you have to switch disks too much). While floppies are somewhat expensive, they're lots cheaper than trying to recover a hard disk with lots of work ▶



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#437



Warfare...

on it. Get a few extra boxes, format them, and keep them only for backups.

You're going to notice that if you try to read one of the disks produced by this program, nothing happens. In fact, GEM thinks the disk is blank. There's a good reason: we've numbered the sectors from 11 to 20, instead of 1 to 10. Why? Not just to irritate you; it used to be we numbered from 1 to 10. Problem: if you ever tried to read the disk from GEM, GEM would crash. This happened to us a fair amount while testing; we'd typically leave the last disk in after doing a

should write and which at 5 volts, indicates the floppy should read.

Moving along with the story, they discovered that for a brief period (50 milliseconds) at powerup, the control line would remain low, compliments of the idiot floppy controller chip; the drive would then briefly select, and write garbage at whatever track the head was on. The people in this story had to issue a field revision to all their disk drives to fix this problem. Switching to the modern day, my AT&T 6300 is fully capable of glitching the hard disks that are inside it if I power up or power down without parking the heads.

The problem is often subtle. Many times you don't find the scragged sectors for weeks, or until they destroy something critical. Furthermore, it doesn't do it every time, just every so often. The solution: religiously park the disk heads off of the read/write area of the disk before you power down (hence, they will be out of the way when you power up). Supra and Atari both supply a parker program (SHIPPRG and PARK.PRG respectively) that do this. They seek the disk head out to track 640, which is unused on a hard disk. Then, when you glitch the power, it can write trash all it wants to the hard disk without hurting anything. Use it. Use it. Use it. (Editor's Note: *Supra engineer Mark White suggests parking your drive whenever you move it, but doesn't find it necessary to do so whenever you power down.*)

If you do manage to mangle a sector (kicking the table while the hard disk is busy is a great place to start), you'll probably have to reformat the drive, using a low-level formatter. This actually rewrites the sector headers and such on the drive, much like a floppy format, as opposed to merely recreating the directories or other cake frosting. Note also that hard disk manufacturers *deny, deny, deny* that anything like this could possibly happen on their drive, although they will admit that it could happen to a competitor. Note also that hard drive manufacturers pointing the finger at each other has meaning.

CONCLUSION

Well, there you have it, Dan and Dave's Indispensable Disk Utilities. You won't find them anywhere else. We hope they find many contented hours spinning on your hard disk, and we honestly hope they keep you out of the same trouble we got in. We'd like to express our thanks to Willie Brown at Supra, who provided much help during many dark debug hours. Kudos also to Atari for uploading their autobooter to CompuServe. Finally, many thanks to Amenophis Fikee, Monboddo Romanelli, and Tim Powers for their copy of the Egyptian Book of the Dead. ■

**We finally
managed to get the
hard disk running by
(of all things) taking
the drive apart, switching
off the drive mechanism
select, booting the ST,
then switching the drive
select back on.**

backup and accidentally read it. So, we renumbered the sectors so you couldn't crash GEM with them, just to be user-friendly. Meg-A-Minute is *not* particularly friendly about hard disk errors. If you have a bad sector, you've got a problem; if you have a bad sector in the directory, you have a *big* problem. There's really not very much we can do about this. Meg-A-Minute will ignore a lot of errors, just letting you know they happened so you can go clean up after them.

So you've got a bad sector, eh? I wonder how it got there. Read on . . .

THE DREADED R/W-NOT LINE

A little fable you should be aware of: Once upon a time there was a little floppy disk drive company in Texas. They made a fast little floppy drive for the 8-bit Atari. Anyway, they noticed after awhile that powering up the system with a floppy in the drive would sometimes glitch the floppy, producing a bad sector. The problem was subtle. There's a control line to the floppy disk drive which, at 0 volts, indicates the floppy

CAMBRIDGE LISP

FROM METACOMCO

AT LAST, AN AI PROGRAMMING ENVIRONMENT FOR THE ST!

REVIEWED BY
CHRISTOPHER F. CHABRIS
CONTRIBUTING EDITOR

Cambridge Lisp
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The Atari ST's move into the Artificial Intelligence (AI) field has awaited the proper tools, such as Lisp and Prolog language environments. For over a year, David Betz's public-domain XLisp interpreter was the only choice (see "The AI Apprentice: Explore Expert Systems with XLisp," *START*, Fall 1986). OSS's long-awaited Personal Prolog is still held up as of this writing.

However, Metacomco has made a strong effort to remedy the situation by releasing the Cambridge Lisp package. While Cambridge Lisp is by no means the ideal AI programming environment, it is a solid ST product with many welcome features to recommend it.

Cambridge Lisp is a comprehensive Lisp package, including an interpreter and a compiler, an editor, and a 350-page manual. Metacomco's GEM-based shell program, MENU+, ties the package together, providing access to various applications through drop-down menu selections. (Editor's note: a review of MENU+ appeared in issue three of *START*, Winter 1987.) A collection of utilities for deleting, renaming, and cataloging files is thoughtfully provided for use with the shell. It is even possible to customize the shell menu should you be unhappy with the supplied configuration. I must admit I did

not find the shell as convenient to use as my favorite command-line interface (Micro C-Shell), but it is a useful inclusion for those who prefer a mouse interface to their development tools.

BACKGROUND

Cambridge Lisp is a dialect of the Lisp programming language Lisp (for LISt Processor) was invented in the late 1950s by John McCarthy and his associates at Stanford University. Cambridge Lisp is an extended version developed at Cambridge University, originally for the purpose of research into symbolic mathematics. It is based on Portable Standard Lisp, a machine independent version of Standard Lisp created in the mid-1960's. Cambridge Lisp is available for many other computers, including the Commodore Amiga.

This long and broad development history ensures that the major design decisions involved with Cambridge Lisp were neither based on whim nor taken in haste. However, it also ensures considerable variance from the predominant Common Lisp standard, adopted, in one form or another, by most Lisp vendors in the United States.

FIRST IMPRESSIONS

My first project with Cambridge Lisp was to port a computer vision program, written in Franz Lisp, from a VAX to the ST. Since the Franz dialect is relatively similar to Common Lisp, upon which XLisp is based, I originally tried XLisp as the target language. Unfortunately, XLisp lacked the necessary trigonometric support functions (and I did not feel like adding them to a customized version of the interpreter), so I switched to Cambridge Lisp, relying on its excellent mathematical capabilities to make up for the differences between the dialects. ▶

Lisp...

I was pleased to discover that Appendix 3 of the manual was entitled "Converting to Cambridge Lisp," but was disappointed to find little usable information there. There were no instructions on converting from particular dialects of Lisp, only hints on functions which have unusual names or are unavailable in Cambridge Lisp. For example, the manual mentions the omission of the LET and DO macros, but offers no solution to the problem.

Suffice it to say that the project is still unfinished as of this writing. To make the translation, I had to re-implement several Lisp functions which seemed to me essential but are nevertheless missing from Cambridge Lisp. From trying to port a couple of other Franz Lisp and XLIsp programs to Cambridge Lisp, I've concluded that the Cambridge Lisp dialect is not the easiest one to move to for a programmer with experience in Common Lisp and/or its variants.

Cambridge

**Lisp is a comprehensive
Lisp package, including
an interpreter and
a compiler, an editor,
and a 350-page manual.**

However, programmers with little or no Lisp experience will not have such problems; instead, they will face the normally steep learning curve associated with the transition from procedural languages like C and Pascal to an applicative one like Lisp.

DOCUMENTATION

While the Cambridge Lisp manual does little to speed this learning process for new users, providing no tutorial introduction and few examples, it does an adequate job as a reference document for experienced users. Since the manual is such an important part of a language product, we will discuss it before we discuss the software itself. I would advise all Cambridge Lisp users to read the manual before getting down to any serious work.

The first part describes the "generic" items in the Cambridge Lisp programming environment, including the MENU+ shell, ED screen editor, and various file-management tools. In the second part, twenty-two short chapters introduce

and discuss the important Lisp-specific portions of the environment, including the interpreter, compiler, and debugging features. Part three briefly explains each primitive Lisp function and object in the customary stylized format.

Part four's documentation of the large library of GEM interface functions is similar, so don't expect to find enough information on AES and VDI here alone: count on consulting a reference work like the *Programmer's Guide to GEM* (Sybex, 1986). Actually, it is unfair to fault a third-party language reference manual for failing to document functions built into the ST itself. Metacomco is to be commended for documenting its own libraries as thoroughly as it has and, especially, for taking the time to compile a 19-page index of the manual. Overall, the Cambridge Lisp manual is a good one; with the addition of a glossary of unfamiliar terms (such as "open coded"), it could be one of the best around.

INTERPRETER

The Cambridge Lisp interpreter provides the work environment (or "total computing world," as the manual describes it) from within which you will do all your program development. It is dynamically scoped, and offers virtually all the basic Lisp primitives for arithmetic, logical operations, input/output, control, function definition and application, and of course list manipulation (also including set lists, association lists, and property lists).

Additionally, several groups of "advanced" features are supported; these include macros, reader macros, and syntax tables, big numbers and extensive mathematical functions, vectors (as true Lisp values), prettyprinting, I/O with "selectable streams," and time functions. One can also customize the top-level Supervisor environment and preserve the state of the system in a binary file for later restoration.

The error-handler and debugger are fairly complete and helpful. Error messages are clear, and the tracing facility invoked with the TRACE and UNTRACE functions provides reams of information on each function call. As for the garbage collector: it works—what more is there to say? For those interested in its inner operations, the manual references a paper describing the underlying algorithms.

A few esoteric features are offered, such as an AVL-tree package (AVL trees are balanced trees normally used for efficient searching operations.) However, the string handling package is quite weak, and the DO and LET macros are not included. In general though, all the important features plus many enhancements are present—you just might have to read the manual carefully to find them all.

COMPILER

The Cambridge Lisp compiler is built into the interpreter environment and is normally accessed through the COMPILE function, which simply translates one or more functions

directly into 68000 machine code. The compiler can be directed to keep its output in memory or to save it to a binary disk file as a load-on-call module. The compiler treats all variables as lexically scoped unless they are explicitly declared to be either FLUID or GLOBAL.

The compiler sports a good collection of switches and options, including the ability to reduce error-checking to improve efficiency, to embed profiling code in its output, and to save the original function definitions after their conversion to machine code. By setting an interpreter flag, you can cause all new function definitions to be automatically compiled.

COMPLAINTS

A version of the ED screen editor provided in the package is also built into the Lisp interpreter itself. While this thoughtful inclusion does aid interactive program development, it uses up about 30K of memory (and disk space) which could be available for list structure and source code files. Also, there is no function which calls the editor and automatically loads the edited file into Lisp. Finally, although it is a reasonable editor, I am no fan of ED, since I use a version of MicroEmacs for all my program editing. Perhaps in the next release Metacomco will allow the use of any screen editor so users will not have to learn ED only to call it occasionally from within the interpreter.

I had trouble installing the system on my hard disk and had to call Metacomco more than once for technical support. Although the representatives with whom I spoke were courteous, friendly, and responsive, they did not call back as promised. To be fair, Metacomco recommends that users write with questions, so they probably put more effort into answering such requests.

Of course, in any first release of software this complex, there are the expected minor bugs and/or errors in documentation that must be dealt with. The problems with Cambridge Lisp seemed to be related to the fact that it was ported from a generic product to the ST environment. For example, the file named LISPRC is not automatically loaded when the interpreter is started up (the manual says it should be), and the image file directory does not default to IMAGE as the manual says it should.

Although its interpreter and editor run as text-only .TOS applications, Cambridge Lisp provides excellent GEM support, with libraries for all the VDI and AES functions available on a load-on-call basis. Special functions are used to access GEM's variables, providing for a complete Lisp-style interface to this portion of the operating system. Unfortunately, there is nothing comparable to the Line-A, BIOS, XBIOS, or GEMDOS calls. Line-A is ignored completely, while the others are accessible by function number and arguments. This is workable, but less than ideal.

I like the Cambridge Lisp compiler, but was disappointed

to find that it cannot be used to create stand-alone applications launchable from the Desktop or a command-line interface. If you need such a facility in order to distribute your programs to users who don't own Cambridge Lisp, you must contact Metacomco and discuss "details of licensing arrangements," whatever they may be. (This gem of knowledge is hidden on the obverse side of the manual's title page.) In addition, there is no documented, direct method to incorporate code written in other languages with your Lisp programs.

CONCLUSION

Cambridge Lisp is truly a high-quality, professional programming environment for AI and other Lisp applications. It is similar to Franz Lisp, a popular dialect used worldwide for both research and development, and is suitable for educational purposes as well. Although the Cambridge dialect is unusual, especially in the United States, and slightly behind the times (for example, no object-oriented programming support), it is certainly workable for most applications. I recommend it.

(Editor's note: For more timely reviews of ST products, from arcade games to hardware, see *The ST Resource*, appearing every month in *Antic Magazine*.)

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Pascal and Modula-2 source code are nearly identical. Modula-2 should be thought of as an enhanced superset of Pascal. Professor Niklaus Wirth (the creator of Pascal) designed Modula-2 to replace Pascal.

Added features of Modula-2 not found in Pascal

- CASE has an ELSE and may contain subranges
- Programs may be broken up into Modules for separate compilation
- Machine level interface
- Bit-wise operators
- Direct port and Memory access
- Absolute addressing
- 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 ARRAY OF REALS)
- Elegant type transfer functions

Ramdisk	Compile	Link	Execute	Optimized Size
Seve of Eratosthenes:	6.2	4.3	3.5	2600 bytes
Floist	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;
  FlagRange = [0..Size];
  FlagSet = SET OF FlagRange;
VAR
  FlagRange:
    i: FlagRange;
  Prime: c, Count, Iter: CARDINAL;
  BEGIN
    BEGIn ('SS-SR-SA-')
    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 Sieve.
```

```
MODULE Floist;
FROM MathLib0 IMPORT sin, ln, exp,
  sqrt, arctan;
VAR x, y: REAL; c: CARDINAL;
  BEGIN ('ST-SA-SS-')
    x := 1.0;
    FOR i := 1 TO 1000 DO
      y := sin (x) * ln (x), y, exp (x);
      y := sqrt (x); y := arctan (x);
      x := x * 0.01;
    END;
  END Floist.
```

```
MODULE Calc;
VAR a, b, c: REAL; n: CARDINAL;
  BEGIN ('ST-SA-SS-')
    n := 5000;
    a := 271828; b := 3.14159; c := 1.0;
    FOR i := 1 TO n DO
      c := c * a; c := c * b; 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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- Kermit - Contains full source plus \$15 connect time to Compuserve. \$29.95
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APL FOR THE ST

APL.68000 (SYMBOLIC)

BY HOWARD OAKLEY

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Since APL was first devised and then put onto IBM mainframes by Ken Iverson and colleagues in the early 1960s, it has attracted a small but devoted following. Enthusiasts recognize it as a language ahead of its time; often, in fact, as the very antithesis of most modern computer languages. APL deals with variables, including scalars, vectors, or arrays of many dimensions, in such a dynamic way that there are no type or range declarations—the variable X could in the same line be a character matrix, then a real scalar, and next a 4-dimensional Boolean array. Program development is surprisingly quick, since APL is an interpreted (not compiled) language. It combines terse code with a very high level of access to the machine. You can sort a character string in but a few APL symbols, and invert a numeric matrix in just one symbol.

This terseness, and the fact that APL draws its symbols from Greek and mathematics rather than the ASCII set, makes programs very hard to read, sometimes difficult even to an expert. However, after a few weeks of learning the language, most people can write functional code. A good ST APL should use GEM fully, combining its graphics and friendly in-

terface with APL's power and speed. Let's examine how well MicroAPL's APL.68000 has achieved this.

IMPLEMENTING THE LANGUAGE

The established 'core' standard for APL is IBM's APLVS. APL.68000 is a much-enhanced superset of the standard. The core of APL.68000 has now been implemented on almost all 68000-based machines. It has the reputation of being one of the fastest interpreters around—and benchmarks are much the same on all 8 MHz machines: a good deal faster than the IBM PC AT, but a little slower than a Vax and the IBM PC RT, although trigonometric functions are not as fast as on an IBM with a 8087 math coprocessor. Floating point math in APL.68000 is all IEEE 64-bit, so numeric accuracy is hard to beat. Over the last few years, I have accumulated a large number of workspaces, running under IBM PC APL. Many of these were typed straight in from mainframe listings. My acid test of the core of APL.68000 was to port these over to the Atari. I used Michtron's superb DFT to actually carry out the transfers, then a few lines of simple APL to perform the final character translation. After a few minor modifications, all my existing code ran superbly.

Figure 1 shows the full-screen function editor in use, and friendly GEM features which make life a lot more productive. APL.68000 uses GEM sensibly to make learning APL much safer and easier. The interpreter and APL programs run in any of the three ST resolutions available.

Since APL is an extensible language like Forth, it is easy to provide functions to carry out additional tasks. Alternatively, you can load additional code through an assembled or compiled program interfaced with APL by an Auxiliary Processor. APL.68000 offers this for those who wish to add their own

APL...

A SHORT HISTORY OF APL

BY PATRICK BASS
START Technical Editor

The computer language APL (A Programming Language) was first developed by Kenneth E. Iverson, while he was teaching at Harvard University in the 1950s and early 1960s. It is a procedure-oriented language, like Pascal or Fortran, insofar as it allows the description of procedures used for solving problems.

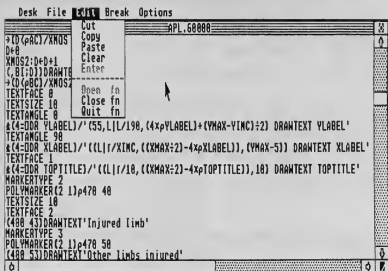
However, APL breaks tradition with Pascal and Fortran by allowing the user to interact in real time with the language. For example, if we type "2+2" into APL, it responds almost instantly with the answer "4", whereas the other two won't. The plus sign acts as an operator which signals APL to take action. It is also possible to write procedures

which are called by other procedures, and which act on previously stored or generated data.

Don't class APL with BASIC because it's interpreted, however, APL is a very powerful language, having operators that perform actions requiring many statements in other languages. This way a beginner can get started with APL within minutes, and yet still have access to the powerful set of APL operators.

The power in APL comes from its use of arrays as the basic data element, and a set of operators of remarkable scope for manipulating arrays. All functions which operate

FIGURE 1: Editing the PLOT function uses GEM well.



extras, and the manuals document it carefully. Additions can also be made to the language, usually in the form of "quad" functions, and MicroAPL has provided a full range of the more useful ones, from Fortran-like formatting to the stripping of leading and trailing blanks. Finally, to the horror of purists, you can actually add more APL symbols.

In the interest of protection, APL.68000 does not have PEEK- and POKE-like instructions to allow memory and machine code access. This inability makes access laborious to GEM functions not provided with the package, requiring you to write code that interfaces through the Auxiliary Processor.

APL.68000 running on a 1040 has a total workspace of up to about 740K—without any desk accessories—well above the customary memory size. You can casually invert 100 x 100 matrices in floating point, or strip blanks from book-length documents. If you are hungry for speed and memory, you'll get satisfaction here.

THE ENHANCEMENTS

APL.68000 for the Atari ST comes with one single-sided disk (without copy protection), a generic manual for the language itself (a thorough reference with excellent tutorial sections), and a slim blue manual covering the ST-specific enhancements. There are six additional workspaces to enable:

- Full use of the ST disk filing system, including extensive error-reporting;
- Reading the mouse and keyboard, support for the clipboard, function keys, input/output via serial and parallel ports;
- Full control of the menu-bar to provide completely GEM-based menu-driven applications;
- Support for extensive dialog facilities and easy use of alert boxes;
- And almost the full complement of GEM graphics and text-drawing functions, even down to program control over colors in the palette.

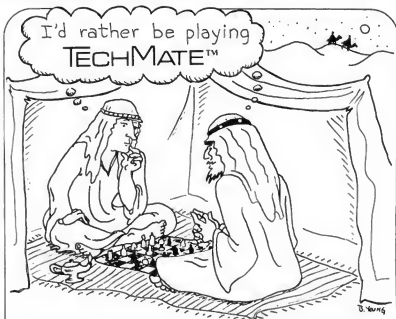
It's remarkable how easily the sophisticated features can be accessed—there is no need for elaborate passing of multiple parameters, or setting up blocks of memory. However, I have two cautions about the GEM functions. They appear to do no checking of parameters—if you pass variables which are out of range, or the wrong type, then locking-up is likely. Second, this lock-up cannot be broken by the APL BREAK facility, since they are effectively non-APL subroutines. Make careful checks on all variables before passing them to the GEM functions. That said, I have been unable to find any bugs in the functions.

upon scalar variables operate in both monadic and dyadic form. This means an operator applied to a single argument may give different results when applied to an argument on either side of itself. For example, the operator which normally returns the largest of two values will, when applied to a single value, return the largest integer which is smaller than or equal to the argument.

One odd feature of APL is that there is no "operator hierarchy," as there is with other languages. Assuming no parentheses are used, expressions are always evaluated right-to-left. In the following example, $3 \times 2 + 3$ will equal 15, not 9.

APL was originally designed to be operated from remote terminals having little or no local memory, so I/O structure in APL has been historically weak. However, recent applications of the language take care of the problem admirably. APL68000, for example, uses the TOS interface fully.

APL has attracted many supporters. There are versions of APL for nearly every machine capable of running it; from IBM mainframes to our beloved ST. You'll find many people who will defend APL to the death, but can't explain why. (Similar to, say, the supporters of Forth.) APL, like Forth, tends to be indecipherable to the unwary reader, and divides the people who come into contact with it into two camps—you either love it or hate it. ■



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LIMITATIONS

APL68000 has two problems you should be aware of. First, the lack of support for printing out APL symbols. I have an IBM Graphics Printer, which my IBM PC APL switches into graphics mode to print out the full APL character set. Although some printer support is provided, APL68000 seems unable to cope with this, and the only way that I can get function listings at present is to dump the screen with the Alt-Help function. (MicroAPL should soon provide printer drivers for Epsoms and the like.) I should stress that this only applies to non-ASCII characters and should not affect an end-user of APL programs.

The second problem is the keyboard arrangement. Since traditional APL uses so many non-standard characters, MicroAPL has provided an APL keyboard configuration, together with keytop stickers. Again, an end-user can be protected from this. As a function you can switch in and out of normal keyboard configuration, and the Control-Tab key combination will do the same interactively. Many people rebel against APL's strange keyboard arrangement, and opt for keywords in place of symbols. Spencer Organization offers APL-Keyword for those who prefer a clean keyboard.

PROSPECTS

In statistics, engineering and other scientific math, APL has few rivals. If number-crunching is your life, then get APL68000 for the ST. However, many others could benefit from its use. If you have to get a sizeable project completed in very short time, or want to produce code that will only be used a few times, the development time saved by using APL will more than repay your effort in learning it. I use APL to produce prototype programs, or explore algorithms, before coding in other languages (such as Modula-2). It is also easy to produce language emulators in APL, so that you can code in your chosen (compiled) language, and test, refine and debug interactively in APL before running the compiler.

A few years ago, finished products in APL were few. However, APL68000 on the ST can offer you the facilities for a completely professional product—GEM-based, with high quality. When you consider the relative cheapness of the hardware and the interpreter needed, it is a very realistic proposition for both programmer and customer. In short, I am delighted with it. ■

(Editor's note: For more timely reviews of ST products, from arcade games to hardware, see *The ST Resource*, appearing every month in *Antic Magazine*.)



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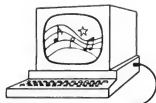
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- Mike Fleischman, ANTIC: The Atari Resource, Sept. 1986

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ST Database Management Systems

AN OVERVIEW

by Brian Lee

The ST has been in developers' hands for two years now, and is finally being blessed with database programs. Just how good are they? START's business expert Brian Lee takes a look at ten ST programs designed to help you keep track of what goes where.

The term *database management system*, or DBMS, has been widely used since the advent of computers. DBMSs have long been used to organize and maintain large collections of business information. However, most of the early DBMSs were designed specifically for large mainframe computers. Smaller businesses could not afford to use the power of these DBMSs until the introduction of powerful personal computers and products like dBASE.

There are now a variety of databases available for the ST—some good, some bad, with prices ranging from \$50.00 to \$150.00. In this article, I will present a quick summary of ST database features, which I hope will shorten your head-scratching time when you next visit your local computer store and look for an ST data management program. At the

very least, this article should enable you to ask the right questions before you make your purchase. But first, some background material is in order.

WHAT IS A DATABASE?

The term *database* simply refers to a collection of useful information organized to facilitate easy retrieval and processing. Personal computers such as the RAM-abundant ST, with the horsepower of the Motorola 68000 chip, offer a cost-effective way to store relatively large amounts of information while providing flexible and fast access to data.

Databases can range in complexity from a simple name and address file to complete accounting and inventory control systems. A simple name and address file could include the following data items:

FIRST NAME

LAST NAME

ADDRESS

CITY/STATE

ZIP

The data stored in this data base could be organized as follows as illustrated in Figure 1.

Each piece of information, for example *first name*, is called a *field*. Each row is a collection of fields of data and represents the information for one person. This collection of fields is referred to as a *record*. Simply put, a database is a collection of records.

The above list, however, may not be the most systematic approach to organizing your records. For instance, we would probably prefer to view the records in alphabetical order by last name or perhaps sorted by zip code. This rearranging of data is typical of the flexibility offered by the DBMS.

WHAT IS DATA?

All information contained in a database can be called data. Data can be categorized by its nature and use in applications. Generally, data can be classified into two broad groups: *alphanumeric* and *numeric*. Some DBMSs use additional categories and subcategories for special data like dates or pictures.

Alphanumeric data consists of alphabetic characters (A-Z), numerals (0-9), and common symbols like punctuation marks. Alphanumeric data is treated as text by the DBMS and cannot be used for computations.

Numeric data represents a quantity. It is treated by the DBMS as a value which can be used for computations and included in mathematical formulas.

TYPES OF DATABASES

The information stored in a database can be organized in many ways. The most conventional models of organization are *hierarchical* and *relational* models.

Hierarchical data bases are rigidly structured, organizing their contents in a configuration resembling a tree. (A good example would be a flowchart.) This tree not only defines the data elements but also the relationship between the elements. While these tree struc-

FIGURE 1: Sample mailing list.

FIRST NAME	LAST NAME	ADDRESS	CITY/STATE	Zip
Gordon	Wong	434 Eyeglass Rd.	Mill Valley, CA	94054
Mike	Silva	787 Forte Ln.	Oakland, CA	94610
Roy	Wolford	123 Paco Ave.	Corte Madera, CA	94903
Allen	Orcutt	943 Ronco Dr.	Vegamatic City, CA	95065

tures can vary in complexity; they are always characterized by their well-defined structure. Contents of the data base are inextricably linked to the structure. A common example of a tree structure is the typical organizational chart shown in Figure 2.

Most hierarchical databases contain their information in a single data file. *File managers* reflect this characteristic, indicating their reliance on a single disk file as the major structural element. Within this file, data elements can be

They are well suited to virtually all home database applications.

On the other hand, relational databases organize data into collections of two-dimensional tables consisting of rows and columns. Each row contains information for one record in the table. Within each row, information is divided into separate fields. As a result, each data element can be referenced by a unique row and column location within the table.

A single database can contain many of these tables with each table existing as a separate data file. Data in different tables can be linked by establishing a relationship between the tables based on matching data. This is the key feature of the relational model; the separation of the data itself from the structure of the database. The relational model permits the easy restructuring of the database by simply redefining the network of relationships between tables without affecting the contents of the tables. Truly relational data bases are complex programs and, as a result, challenging to make user-friendly. In the IBM market several products have made major steps towards simplifying the use of relational data bases. In particular, R:BASE System V has created a completely menu-driven shell which allows the user to visually define and edit data tables.

This
should enable
you to ask the right
questions before you
make your purchase.

grouped by common characteristics (as in the Marketing Department, in the above example). While hierarchical databases are conceptually easy to deal with, they are severely limited by their ability to change their organizational structure depending on the needs of the user.

File managers are generally simple-to-use, highly effective tools for managing personal databases like addresses, recipes, tape collections, and the like.

A common application of relational data bases is accounting systems. A business will generally have a collection of regular customers, each with their own ▶

DATABASES...

address, credit terms, etc. When the business receives an order, an invoice must be prepared. To do this, information about each of the items being sold as well as the customer information must be gathered. A file manager would require all information for each invoice including customer address and the information for each element purchased to be included in each record. As a result, valuable disk space is wasted carrying redundant data. The relational model overcomes this by allowing customer addresses to be contained in a separate table referenced by the customer's name. In addition, the information for each of the items being sold (description, price, etc.) can be maintained in a separate table referenced by a part number. Under this model, the invoice only needs to store the customer name and part numbers to complete the invoice.

WHAT TO LOOK FOR WHEN PURCHASING DATABASE SOFTWARE

For purposes of simplicity here, I will use two categories for my brief database reviews: File managers and Relational DBMS. (I'll generalize the term file managers to encompass all non-relational products.) While some may dispute my definition of relational database managers, I will use the most rigorous meaning. To be considered a relational DBMS, the product must maintain separation of data contents from the structure of the database to facilitate flexible and dynamic restructuring of the database.

The most important criteria for deciding which database product is right for you is to define your objective

Data can be organized by its nature and use in applications.

carefully. For most applications, a file manager will give you the benefits of ease of use and simple management of your data. If you must manage large amounts of complex data and are willing to invest additional time and money, the relational products reviewed here will give you the power necessary.

I have reviewed several products in each category. All the databases share common features, but I will focus on those features which make the product unique. The START charts at the end of the article will provide more detailed information for product-to-product comparison.

MailList from Artworx

MailList, as its name implies, is designed to manage a name and address file. The program supports one key field and five data fields of up to 32

characters. The program will handle up to 1800 records on a single-sided disk. MAILLIST's user interface is by command line, making no use whatever of GEM or the mouse. The documentation consists of one small double-sided sheet of paper containing a "tutorial." While this tutorial takes you through some of the functions of the program, there is no explanatory text accompanying the directions for what keys to press. Even considering its low cost, this program is not up to commercial software publishing standards.

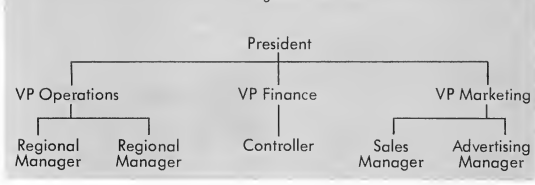
Datatrieve from Abacus

Datatrieve is a well-designed product which makes good use of the GEM interface and also gives you quick access to all functions from your keyboard. The program allows you design screen and report masks which can include graphic elements like boxes and shaded areas as well as font specifications. In fact, you can even specify different fonts for the field names and field contents. Datatrieve allows records of up to 64000 characters and text fields of up to 32000 characters. Files can be indexed on up to 20 fields and searched using wildcards, substring matches, and ranges. Reporting is somewhat limited to labels and lists with a single-level break. Page headers and subtotals are possible. The 123-page documentation is quite good, with numerous illustrations.

dbMaster One from Stoneware

dbMaster One consists of three separate programs: one for creating a database, one for maintaining a database, and one for data import and export. The program makes good use of GEM for the creation of the database, allowing the user to stretch fields to the desired size. One of the unique features of the program is the support of multiple lines of data for a given field. The lack of integration between the three program modules is a bit of a nuisance but not a major drawback.

FIGURE 2: Organizational tree.



HabaView from Haba Systems

HabaView uses a columnar format to display data. This model is very much like a spreadsheet, with each row corresponding to a record and each column representing a field. The program also makes very good use of the GEM interface. It is easy to stretch a column to a new length by dragging its right edge, and columns can be reordered easily. HabaView also provides the option of viewing the data in the more conventional "form" view. Fields in the form can be easily resized and moved. The program also has some nice touches like optional automatic capitalization of the first letter in the data, which can save time when entering names and the like. Multilevel sorts are supported through use of "progressive" sorts. Lists and labels are supported but the user cannot create flexible custom report formats. The 58-page documentation is quite good at explaining the operation of the program. Overall, an easy-to-use program but one which might limit the more ambitious user.

Zoomracks II from Quickview Systems

Zoomracks II is a radical departure from conventional database programs and does not fit neatly into a category. Zoomracks II is based on the analogy of cards in racks, like those found next to timeclocks. The program does a good job of insulating the user from the usual concerns of field types, lengths, and file handling. The documentation and accompanying reference card and keyboard template are also well designed and easy to follow. Several pre-designed applications are available as separate products. One of the most unique features is the program's ability to include DEGAS picture files in the data base. This is clearly a product driven by a singular vision, which provides an innovative approach to data management. The product provides strong functionality at relatively little effort on the part of

the user. First-time-users of databases are likely to find the rack analogy more intuitive than those of us prejudiced by experience with more conventional products.

Data Manager ST from Timeworks

Designed to integrate with Swiftcalc ST and Word Writer ST, Data Manager ST is a powerful and well-designed product. It makes full use of the GEM interface as well as the function keys, a reference for which is displayed on screen. The program uses a columnar list format like that of HabaView and also provides a form view. However, Data Manager ST goes a couple of steps further by providing calculated columns and flexible custom reports. The user can re-size and relocate columns, although moving a column requires more keystrokes than with HabaView. Data Manager ST provides flexible report creation and even

menus which you can select by number. The program does not make use of GEM, nor does it use the mouse. Yet the key to this product is its powerful programming language, Manager Math. Manager Math is actually a procedural language which can handle data manipulation and even multiple file operations. Functions included permit not only calculations but also string manipulation. This permits the creation of custom reports and data entry screens. The excellent documentation which accompanies the program is very thorough and replete with examples. If you are familiar with file managers on other computers like Apples or IBMs, you should feel right at home with this product. This is a polished product which looks like a conversion from the IBM (it even uses the numeric keypad for PgUp and PgDn just like IBM!).

Trimbase from Talent Computer Systems

Trimbase utilizes GEM and the familiar concept of a card file to represent data. The program purports to be a fully relational database management system, providing functions for merging and joining disparate data files into new files. However, this one-time processing of files accomplishes only a snapshot of the relations between the data files. Updating of information in the source files is not represented in the destination file until the joining function is completed. Trimbase includes a macro recording facility to expedite this process. Overall the product provides fairly easy access for the non-programmer to relational functions, but would be less appropriate for development of custom turnkey systems.

dBMan from Versasoft

dBMAN is a serious database management system. Compatible with the industry standard dBASE III, dBMAN provides the custom database system developer with the flexibility and power necessary to develop turnkey systems. ▶

The most conventional models of organization are hierarchical and relational models.

business graphics in the form of bar graphs, line graphs, and pie charts. The 161-page manual is extremely well done and easy to read. This is an excellent and professionally done product which does an admirable job of balancing power and ease of use.

The Manager from BMB Compu-science

The Manager is a menu driven file manager. It uses standard item list type

DATABASES...

The program supports command files (though limited to 236 characters), local and global memory variables, and permits flexible report creation. The documentation is a well organized reference to the commands and functions of the program. The product is clearly aimed at experienced database designers. There is no provision for menu-assisted applications development or report generation like those found in dBASE III Plus or R:BASE on the IBM. Also, the user interface is by command line only. There is no link to GEM by applications developed using dBMan. However, the company is reportedly working on a GEM interface at the time of this writing.

Regent Base from Regent Software

Regent Base provides both a GEM-based interface and procedural language for applications development. The program provides a unique form design capability which includes action buttons. You can make these buttons perform predetermined functions by activating them with the mouse. Several preset applications are included, ranging from mail lists to check registers. The documentation is sketchy and void of illustrations, a problem which Regent is addressing in version 1.1. Regent treats data internally as tables with a full complement of relational operators. Regent Base, like dBMAN, is suitable for custom database applications development. It is clearly targeted at the ST market, providing access to GEM for programming application screens. Its syntax is somewhat unconventional, a problem which will be mitigated by the revised manual.

CONCLUSION

The Atari ST market is still relatively young. At this point, many of the database products available lack the power and polish found in similar products in the IBM market. To put this in perspective, however, you must remember the

IBM PC software market has been in existence since 1981, and can thus be called "mature." As the ST establishes its own standards of (dare I say it?) "Power Without The Price," we can expect higher-quality, more greatly polished software to hit the market, from both the above manufacturers and others. While the IBM market continues to set the standards for databases, the ST database products have the potential for creating completely new standards—their own. ■

REFERENCE:

- *MailList*
Artworx
150 N. Main St.
Fairport NY 14450
(716) 385-6120
\$1795
CIRCLE 164 ON READER SERVICE CARD
- *Datatrive*
Abacus Software
P.O. Box 7219
Grand Rapids, MI 49510
(616) 241-5510
\$49.95
CIRCLE 165 ON READER SERVICE CARD
- *dbMaster One*
Stoneware (distributed by Atari Corp.)
Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000
\$49.95
CIRCLE 166 ON READER SERVICE CARD
- *HabaView*
Haba Systems
6711 Valjean Ave
Van Nuys, CA 91406
(818) 989-5822
\$59.95
CIRCLE 167 ON READER SERVICE CARD
- *Zoomracks II*
Quickview Systems
146 Main Street, Suite 404
Los Altos, CA 94022
(415) 965-0327
(\$14995
CIRCLE 168 ON READER SERVICE CARD
- *Data Manager ST*
Timeworks, Inc.
444 Lake Cook Rd.
Deerfield, IL 60015
(312) 948-9200
\$89.95
CIRCLE 169 ON READER SERVICE CARD
- *The Manager*
BMB Compuscience Canada Ltd.
500 Steeles Ave.
Milton, Ontario L9T 3P7
(416) 826-2516
\$149
CIRCLE 170 ON READER SERVICE CARD
- *Trimbase*
MichTron
576 South Telegraph
Pontiac, MI 48053
(313) 334-5700
\$99.95
CIRCLE 171 ON READER SERVICE CARD
- *dBMan*
Versasoft (distributed by Atari Corp.)
Atari Corp.
1196 Borregas Ave.
Sunnyvale, CA 94086
(408) 745-2000
\$149.95
CIRCLE 172 ON READER SERVICE CARD
- *Regent Base*
Regent Software
7131 Owensworth, Suite 45A
Canoga Park, CA 91303
(818) 882-2800
\$99.95
CIRCLE 173 ON READER SERVICE CARD

START CHART

RELATIONAL DBMS

TITLE	REGENT BASE	TRIMBASE	DBMAN
COMPANY	REGENT	MICHTRON	VERSASOFT
REVISION		1.42	2.00
PRICE	\$99.95	\$99.95	\$149.95
FILE LIMITS	FIELDS/RECORD	UNLIMITED	↑
	RECORD SIZE	UNLIMITED	ONE SCREEN
	RECORDS PER FILE	DISK	32000
	RECORDS PER DATABASE	UNLIMITED	N/A
	MAX FIELD SIZE	32000	↑
DATA TYPE	CHARACTER	Y	Y
	INTEGER	Y	N
	FLOATING POINT	Y	Y
	LOGICAL	N	N
	DATE	Y	Y
	LONG TEXT	Y	Y
ENTRY	RANGE TESTING	Y	N
	DEFAULT VALUES	Y	N
	LOOKUP TO EXTERNAL TABLE	Y	N
	MUST FILL FIELD	N	N
	FORCED UPPER CASE	N	N
	DATE CONVERSIONS	Y	Y
	AUTO INCREMENT FIELDS	Y	N
	CALCULATED FIELDS ON ENTRY	Y	N
	CARRY OVER DATA	Y	N
IMPORT EXPORT	ASCII	Y	N
	DIF	N	N
	DBF	N	N
MANIP	INDEXING	Y	N
	MAX INDEX FILES	UNLIMITED	N
	COMPOUND INDEXES	UNLIMITED	N
	CAN RESPECIFY INDEX FIELDS	Y	N
	CAN RESPECIFY FILE DEFINITION	N*	Y
	SORTING	Y	Y
	MAX SORT FIELDS	3	UNLIMITED

* = WILL BE INCLUDED IN REVISION 1.1.

↑ = No limit within maximum record size.

N/A = Information not available.

START CHART

RELATIONAL DBMS

TITLE		REGENT BASE	TRIMBASE	DBMAN
COMPANY		REGENT	MICHTRON	VERSASOFT
REVISION			1.42	2.00
MANIP (cont.)	ASCENDING	Y	Y	Y
	DESCENDING	Y	Y	Y
	MAX OPEN FILES	UNLIMITED	1	10
	BATCH UPDATE/DELETE	Y	N/A	Y
OTHER	COMMAND LINE INTERFACE	Y	N	Y
	USES GEM	Y	Y	N
	SCREEN PAINTER	Y	Y	N
	COPY PROTECTED	N	Y	N
	ON-LINE HELP	N*	Y	N
	DOC	200 PGS	65 PGS	350 PGS
	REPORTS	ARITHMETIC FUNCTIONS	Y	Y
AGGREGATE FUNCTIONS	Y	N	Y	
STATISTICAL FUNCTIONS	Y	N	N	
MULTIPLE FILE REPORTS	Y	N	Y	
PREDEFINED MAILING LABELS	Y	N	Y	
PAINT REPORT FORMATS	N	Y	N	
PROGRAM REPORT FORMATS	Y	N	Y	
HEADERS	Y	Y	Y	
SAVE REPORT FORMATS	Y	Y	Y	

* =WILL BE INCLUDED IN REVISION 1.1.

† =No limit within maximum record size.

N/A =Information not available.

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FILE MANAGERS

	PRODUCT NAME:	MAIL-LIST	DATA-TRIEVE	DATA-MANAGER ST	DB MASTER ONE	THE MANAGER	ZOOM-RACKS II
	COMPANY:	ARTWORX	ABACUS	TIMWORKS	STONEWARE	BMB COMP.	QUICKVIEW
	REVISION:	1.0	1.16	1.0		1.20	2.0
	PRICE:	\$17.95	\$49.95	\$89.95	\$49.95	\$169.00	\$149.95
FILE LIMITS	FIELDS PER RECORD	6	UNLIMITED	LIMITED BY MEM	100	UNLIMITED	27
	RECORD SIZE	182	64000	LIMITED BY MEM	3000	58000	519000
	RECORDS PER FILE	1800	64000	LIMITED BY MEM	UP TO 320KB	UNLIMITED	10000
	RECORDS PER DATABASE	1800	UNLIMITED	LIMITED BY MEM	UP TO 320KB	UNLIMITED	10000
FIELD TYPES	MAX FIELD SIZE	32	32000	256	3000	1840	20000
	CHARACTER	Y	Y	Y	Y	Y	FREE FORM
	FLOATING POINT	N	Y	Y	Y	Y	FREE FORM
	LOGICAL (Y/N)	N	Y	Y	N	N	FREE FORM
	DATE	N	Y	Y	Y	Y	FREE FORM
	LONG TEXT (MEMO)	N	Y	N	Y	Y	FREE FORM
DATA ENTRY	RANGE TESTING	N	N	N	N	Y	N
	DEFAULT VALUES	N	N	N	N	Y	N
	REQUIRE SPECIFIC VALUES	N	N	N	N	Y	N
	LOOKUP TO EXTERNAL TABLE	N	Y	N	N	Y	N
	MUST FILL FIELD	N	N	N	N	N	N
	FORCED UPPERCASE	N	Y	Y	N	Y	N
	AUTO INCREMENTING FIELDS	N	N	Y	N	Y	N
	CALCULATED FIELDS ON ENTRY	N	N	Y	N	Y	N
	CARRY DATA FROM PREVIOUS	N	N	Y	N	Y	N
	ASCII	Y	Y	EXPORT ONLY	N	Y	Y
	DIF	N	N	EXPORT ONLY	N	Y	N
DBF	N	N	N	N	Y	N	
DATA MANIP	INDEXING	Y	Y	N	N	Y	Y
	MAX INDEX FIELDS	1	20	N	N	UNLIMITED	UNLIMITED
	SORTING	Y	Y	Y	Y	Y	Y
	MAX SORT FIELDS	1	25	UNLIMITED	3	UNLIMITED	1 AT A TIME
	ASCENDING	Y	5	Y	Y	Y	Y

START CHART

FILE MANAGERS

	PRODUCT NAME:	MAIL-LIST	DATA-TRIEVE	DATA-MANAGER ST	DB MASTER ONE	THE MANAGER	ZOOM-RACKS II
	COMPANY:	ARTWORX	ABACUS	TIMWORKS	STONEWARE	BMB COMP.	QUICKVIEW
	REVISION:	1.0	E 1.16	1.0		1.20	2.0
	PRICE:	\$17.95	\$49.95	\$89.95	\$49.95	\$169.00	\$149.95
DATA MANIP. (cont.)	DESCENDING	N	5	Y	Y	Y	N
	MAX OPEN FILES	1	1	1	1	21	9
	BATCH UPDATE/DELETE	Y	Y	DELETE ONLY	N	Y	Y
SEARCHING	EXACT MATCH	Y	Y	Y	Y	Y	Y
	WILDCARD	Y	Y	Y	Y	Y	Y
	CONTAINS STRING IN FIELD	N	Y	Y	Y	Y	Y
	CONTAINS STRING IN RECORD	N	Y	Y	N	Y	Y
	RANGE	N	Y	Y	Y	Y	N
	"AND CONDITIONS"	N	Y	N	Y	Y	N
	"OR CONDITIONS"	N	Y	N	N	Y	N
	MAX CRITERIA	1	UNLIMITED	1	CAN BE NESTED	UNLIMITED	1
REPORTS	ARITHMETIC FUNCTIONS	N	N	N	Y	Y	N
	AGGREGATE FUNCTIONS	N	N	Y	Y	Y	N
	STATISTICAL FUNCTIONS	N	N	N	N	N	N
	MULTIPLE FILE REPORTS	N	Y	N	N	Y	N
	PREDEFINED MAILING LABELS	N	Y	Y	Y	Y	N
	PAINT REPORT	N	N	MENU	Y	N	N
	PROGRAM REPORT	N	Y	MENU	N	Y	Y
	HEADERS	N	Y	Y	Y	Y	Y
SAVE REPORT FORMAT	N	Y	Y	Y	Y	Y	

We did not have enough product information on Habaview to include it in this START CHART.

The START 1986 Tax Template

BY TOM CHANDLER
ANTIC PUBLISHING ASSISTANT CREDIT MANAGER

Now you can use your Atari ST to help you with your 1986 federal tax return. On the START disk is a folder marked TAX86.ST. It contains a template you can use with VIP Professional, the Lotus-compatible spreadsheet from VIP Technologies. Note: The template requires either a 1040 ST or a 520 with a megabyte of memory.

Like some help with your taxes? The VIP Professional template on this issue's START disk can help you with the following forms:

1986 IRS 1040 Long Form	Schedule G (Income Averaging)
Schedule A (Itemized Expenses)	Schedule W (Working Couples)
Schedule B (Interest and Dividends)	Form 2441 (Child Care Deduction)

WHAT YOU NEED

To use this template, you'll need an Atari ST with at least 1 megabyte of memory, a copy of VIP Professional and your official Internal Revenue Service 1986 tax instructions and forms. It's also helpful to have a printer, since it's easier to copy the figures from a printout than from the screen. If you've never used VIP Professional before, begin by studying the manual. It may take a little time to learn the ins and outs of using VIP Professional, especially if you're unfamiliar with spreadsheets, so don't wait until April 14th!

TAX SPREADSHEETS

Spreadsheet programs are ideal for preparing tax returns. You provide the personal data, then customized formulas tell the program how to crunch the numbers.



Folder TAX86.ST
on your START disk

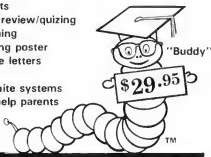
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- Over 80 different graphics
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- Unprotected



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*Gem is a trademark of Digital Research Inc.

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Commands	•	•	•	•
C Shell	•	•	•	•
Electronic Mail	•	•	•	•
Aliases/Macros	•	•	•	•
Command History	•	•	•	•
TOS File System	•	•	•	•
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Programming	•	•	•	•
I/O Redirection	•	•	•	•
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Job Control	•	•	•	•
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Scheduling	•	•	•	•
Print Spooler	•	•	•	•
Runs TOS Programs	•	•	•	•
Runs GEM Programs	•	•	•	•
Supports ST	•	•	•	•
Compilers	•	•	•	•
Password	•	•	•	•
Security	•	•	•	•
Price	N/A	\$295.00*	\$129.95	

*For program development the OS/9 BASIC, Pascal, and C language package is an additional \$495

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CIRCLE 010 ON READER SERVICE CARD

Each data element or formula is entered in a spreadsheet cell—similar to the lines and columns on your tax form. As your data changes (you find another stack of receipts) go to the proper cell, add in the additional data, and your entire tax return will be recalculated.

START's 1986 tax template can be used for many different taxpayers—just save the original version on disk. It should take only about an hour to enter each individual's personal information, and you can save each tax template on disk under a different name.

As you fill in the spreadsheet, you'll need the 1986 IRS tax instructions and forms close at hand. The spreadsheet doesn't duplicate the tax forms exactly, and abbreviations are used wherever possible. But the template follows the IRS line numbers, so you won't get lost.

You will notice that some of the cells use the currency format, while others use the fixed format. Those in the currency format are formulas. Be sure to *not* type over these formulas, since this will ruin the calculations. As an extra precaution you might save a backup "unfilled-out" copy before entering any information onto your working copy.

Perhaps you're one of those taxpayers who must fill out forms that are not on the template. If so, you will have to fill out those forms manually, and enter the totals into the appropriate cell on the template. Once this is done your ST can add them in with the rest of the numbers that you've entered.

Once you've entered information into the spreadsheet, you're ready to print out the information. This can be done in three steps. First, calculate the template (press F9); it wouldn't make much sense to print out the information until you've calculated everything. Second, set the print range to cell A1 through cell G280. Third, align your paper and press G for GO. Soon you will have almost all the information you need to copy onto your tax forms. I say *almost* because the template calculates virtually every line *except* the actual tax you owe. Putting all the tax tables into the template would chew up lots of memory. Instead, figure out your Net Taxable Income on the template, then just look up the matching Tax Table amount in your instruction booklet from the IRS as you fill out your actual 1040 paper form.

It is wise to save your work just in case you need to change something later. This is done with the File Save command. Again, we highly recommend you save your completed work under a different name.

Please examine your template results with great care. If you have any doubt about the accuracy of your findings, get advice from a registered tax preparer. Data entry mistakes and programming errors have been known to occur. START cannot be responsible for any mistakes that might be made in your tax payments as a result of using this template. ■

With the introduction of the ST™ computers comes a new kind of computer language:

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—*Infoworld*

"We have spent the last three months evaluating the Atari and have come to the conclusion that it can't be beat as a low-cost telecommunications terminal, drafting workstation, or for quick graphics visualization."

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"We are most impressed with the clarity of the graphics, with the speed of the disk I/O (input/output), and with the ST's value."

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"With the impressive ST, Atari has delivered on its promise of power without the price."

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—*Byte Magazine*

PRAISE.

"The ST's readily apparent strong point is speed. Compared to the Macintosh™,

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—*John Dvorak, San Francisco Examiner*

"Since the pinouts are standard, it is also possible for various software packages to support an even wider range of output devices—even faster printers and high-end plotters."

—*Microtimes*

"The ST is noticeably faster than the Macintosh, not only because of the faster clock rate but because it has a faster disk drive."

—*Personal Computing*

"The ST is an amazing bargain, much more of a computer 'for the rest of us' than Mac ever was."

—*Byte Magazine*

"From here on you had better think of Atari as a major player in the computer game."

—*Jerry Pournelle, Infoworld*

The 520ST™ with 512K of memory is under \$800. The 1040ST™ with a full megabyte is under \$1,000. No wonder the experts are impressed.

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RESOURCES

BY MATT LOVELESS,
ASSISTANT EDITOR

SE HABLA ESPAÑOL

ST Writer fanatic Bruce Noonan, the author of *ST Writer Secrets* in *START* #3 (Winter 1986), has made yet another enhancement to this fabulous word processor: foreign language support. Available now is a Spanish version of ST Writer, complete with foreign prompts and special characters. Also in the works is a German version, which should soon be available. "ST Writer has become the ultimate user response program," says Dr. Noonan, "People suggest changes and I make them." You can issue suggestions and changes to Bruce Noonan through his CompuServe PPN (72407,504).

CP/M ON YOUR ST

Over ten years ago, Digital Research, the designers of GEM, wrote an operating system called CP/M (Control Program/Microcomputers) for an 8-bit 8080 machine. CP/M was soon adopted as the industry standard and has only recently been eclipsed by the ubiquitous MS-DOS. But there are lots of CP/M machines out there and lots of CP/M software. So Atari wrote a program to turn your ST into a 2 MHz Z80 CP/M machine. The program is called the CP/M Emulator and is available in the public domain, *gratis*. To get a copy, try your local users group, the Atari BBS (408-745-5308), or an information service such as the ATARI16 SIG on CompuServe or the ST roundtable on GENie.

WHAT'S IN A NAME?

When the ST debuted just over two years ago at the January Consumer Electronics Show in Las Vegas, an air of

mystique enshrouded the meaning of the cryptic "ST." Rumors surfaced pointing to the initials of Atari Corp. president Sam Tramiel. When the smoke cleared, the true meaning, "Sixteen/Thirty-two," a tribute to the 68000 architecture, resolved the mystery. But now some new letters have floated into the acronym. What of the STF and the STH? Simple. The "F" means built-in floppy and the "H" means built-in hard drive. (The latter, the 1040 STH, exists only as a prototype in Atari's lab. It was unclear at presstime whether or not Atari would market the STH.)

MULTIUSER ATARI

In a joint venture, VME Trade Limited of England and d/SOFT Limited of New Jersey introduced a three terminal multiple user system running on a 520 ST, hoisting Atari into the small business minicomputer arena. The \$2995 system



includes a 20 MB hard drive and a hardware upgrade—you unplug the 68000 chip and plug in a piggyback board, replace a couple of the TOS ROMs, and you're ready to run the multitasking d/os (pronounced "de-oss") operating system. The modified

Atari emulates a Wyse 50 terminal and allows you to attach two additional terminals. The d/os system runs on a variety of minicomputers, including the Alpha-Micro, the original development environment. "The beauty of the system," says d/SOFT's Michael Lewis, "is that any d/os program can run unchanged on an Atari ST, assuming it doesn't exceed the memory requirements." This vertical market, value-added system will soon find its way into medical offices, video rental stores, and other small businesses. For more information, contact: d/SOFT Limited, 310 Cedar Lane, Teaneck, NJ 07666. (201) 652-1413.

CIRCLE 150 ON READER SERVICE CARD

LIFE IN THE FAST LANE.

Kuma Computers Ltd., the prolific software company known best for their applications programs (such as A-Calc and A-Seka available from *The Catalog*), has produced a parallel 32-bit, 7.5 Mips RISC processor development package for the Atari ST. First, Mips are "Millions of Instructions Per Second," and at 7.5, that's over seven times faster than your ST. Second, RISC (Reduced Instruction Set Computer) processors allow faster program operations by using a smaller but faster set of instructions. In short: it cooks! Called the K-MAX Transputer, the system is based on the Immos T414 32 bit processor and plugs into the ST's cartridge port, allowing program development with the included Immos standard editor/assembler. This system promises to be a major advancement for inexpensive university and corporate research and development. Contact Kuma Computers Ltd, 12, Horseshoe Park, Pangbourne, Berkshire RG8 7JW. International phone number: 44-7357-4335. 1450 Sterling.

CIRCLE 153 ON READER SERVICE CARD

MARCUS BADGLEY

RESOURCES

ST SMALLTALK

Smalltalk helped put Xerox PARC (Palo Alto Research Center) on the boards as the forerunner in object-oriented languages. Now in the public domain is a Smalltalk-like language called Little Smalltalk from the University of Arizona. It's an interpretive, non-graphics subset of Smalltalk-80 (a trademark of Xerox), originally transferred to microcomputers by Bill Kinnersley of Washington State University. The current version was ported to the ST by Dave Clemens. We know a version is available in DL 3 of Compuserve's ATARI16 SIG.

ANTIC ONLINE COMES BACK

After a short leave of absence, Antic ONLINE is now back in full service. Antic Technical Editor, Charlie Jackson, has been appointed Antic ONLINE Editor and oversaw the complete menu restructure and service improvement. Antic ONLINE now has color and black and white RLE pictures and a library of

downloadable files (For example, check Antic ONLINE for data files of icon images for the Icon Editor in this issue). Of course, the familiar feedback areas are still available plus late-breaking news, reviews, and editorial. Type GO ANTIC at any Compuserve prompt.

CIRCLE 154 ON READER SERVICE CARD

FOR THE HOBBYIST

E. Arthur Brown Company of Alexandria, Minnesota publishes the Computer Hobbyist Catalog, selling innovative yet inexpensive software and hardware for the Atari ST. The catalog is free for the asking. Call or write: E. Arthur Brown Co., 3404 Pawnee Drive, Alexandria, MN 56308. (612) 762-8847.

CIRCLE 151 ON READER SERVICE CARD

A BIGGER MONOCHROME SCREEN

Every Atari SM124 monochrome monitor has a one-inch border surrounding the usable portion of the screen. Circulating in the public domain is a small article written by architect and ST developer Jack Durre, detailing a process

to expand the picture size of the monitor. With a Philips-head screwdriver, some TV tuning tools, and about an hour of work, you can expand your screen. Mr Durre's article has appeared in numerous ST users group newsletters and is posted on most ST bulletin boards. Some Atari service centers may agree to make the adjustment out of warranty.

PEOPLE AND COMPUTERS

The University of Wisconsin-Parkside and the Parkside Computer Club are holding their eleventh annual Computer Fair. This year's theme, "People and Computers Now," will illustrate how computer systems and software of today's high-tech society are being used by people. The Atari ST promises to be a main attraction. The fair will be held March 21 at the University of Wisconsin-Parkside's Molinaro conference room from 10:00 a.m. to 4:00 p.m. Admission will be \$2. Children under 12 are free. For more information, contact Darryl Hahn, Box 2000, Kenosha, WI 53140. ■

Kuma K-Max, Transputer development system

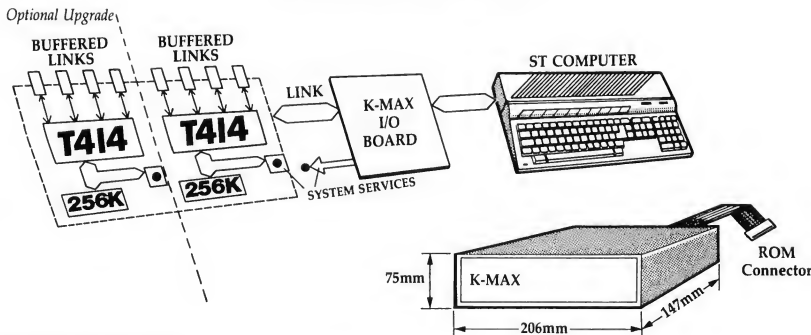


Diagram: Courtesy Kuma Computers Ltd.



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ATARI 520 ST/COLOR GAMES

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MAZE: Develop and test your skills at showing the path through mazes. This program generates random mazes of six different sizes/complexities, and will show you the path if desired.

TINGO: You and your opponent alternate placing dots on a checkerboard to get five dots in a row. Play against a friend or the computer. The computer has six different skill levels, and will always respond immediately. A man versus artificial intelligence game!

BONGO: Find the hidden symbols/colors as in a battleship game. Test your reasoning/ deductive skills with this laid back teaser! 20 game modes.

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- 4 Programs \$54.
- 5 Programs \$60.

All of the programs are fully mouse and menu driven, and have a special demonstration mode to show capabilities and to entertain. They are written in Pascal for fast and robust operation. The executable code is supplied on a low density floppy disk (3.5/5.25/1330), and comes with a 3 month warranty. Archive copies allowed.

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ST-Copy is the fastest, most reliable floppy disk back-up program available for the Atari ST Computers. It backs up both protected and unprotected disks with just the click of your mouse! Also included is FMT, a fast disk formatting utility that gives you increased capacity and load speed. ST-Copy is not copy protected. Copies 1 or 2 sided disks. Updated regularly. New Version 3.0 **Revisions \$10 plus \$35/H.** ST-Copy is just **\$34.95!**

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J-Disk is a fast, configurable ramdisk program for the Atari ST computers. Can be configured to use any size ramdisk from 29K to 821K in a 1 megabyte ST! Uses any drive from A to H as the ramdisk. Includes FMT. No verify-speeds up disk writes by turning off write-verification. J-Disk is just **\$19.95!**

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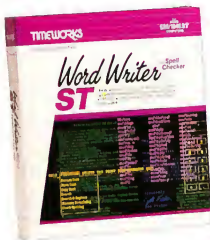
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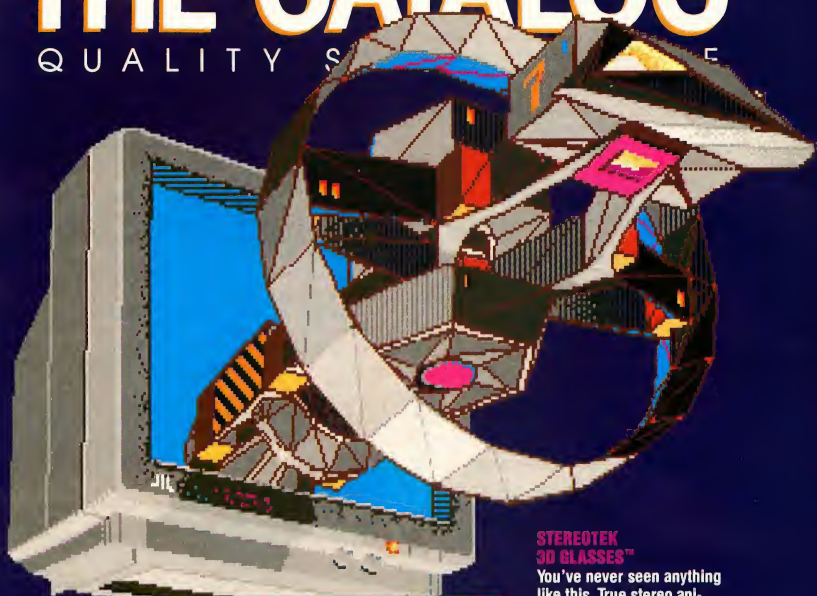
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ST0236 \$89.95

PLOTTER AND PRINTER DRIVERS

For graphics aficionados. Print your CAD-3D creations on a Hewlett-Packard (or compatible) pen plotter. Get 3,000×3,000 line resolution output! Includes 20 custom screen-dump drivers for every popular dot-matrix printer.

(requires CAD-3D)
ST0225 \$24.95

3D-FONT PACKAGE

Use CAD-3D to design professional graphics and animations. From video titles to corporate logos. Includes two detailed font sets.

(requires CAD-3D)
ST0224 \$24.95

Explore the new CAD-3D™ Universe on page 2.

STEREOTEK 3D GLASSES™

You've never seen anything like this. True stereo animated graphics which make CAD-3D creations leap right out of your screen. We've shown this system at computer shows and the crowds have almost knocked our booth over.

(does not require CAD-3D)
TH9020 \$149.95

FUTURE DESIGN DISK

The ultimate 3D clip art library. Everything you need to create your own science fiction fantasy film or artwork. Designed by a professional illustrator and animator to make super graphics easy for you! The **FUTURE DESIGN DISK** was used to create the artwork on this page.

(requires CAD-3D)
ST0232 \$24.95

Image created by Darrel Anderson with CAD-3D and DEGAS Elite.

NEW!

THE CYBER STUDIO™ (2-program set)

Tom Hudson and Mark Kimball take you into a **new dimension!**

Tom Hudson's STEREO CAD-3D™ 2.0

- Works with StereoTek 3D Glasses
- Requires 1 megabyte RAM

If you're just getting started, or if you've already got CAD-3D 1.0, you can now look forward to over a dozen new professional features plus CYBERMATE—The CAD-3D animator. All integrated into THE CYBER STUDIO, a complete professional 3D design package. And the 2-disk set upgrade is only \$40 (plus your original disk and \$5 shipping).

Solid Modelling with Shading. Amazing.

With the new CAD-3D, your ST becomes the most powerful 3D graphics workstation this side of Hollywood. Even if you're not a professional designer, you can use the 3D FONT PACKAGE and FUTURE DESIGN DISK to create network-quality graphics. Professional 3D Clip Art—No artistic skill required! We're talking about digital scene simulation, not just goblets and sugar cubes. The perfect companion to DEGAS Elite.

Look at all these NEW features!

- True STEREO control with perspective adjuster
- Dimensioning for real-world object scaling
- Three independent light source icons, now put them anywhere in the 3D universe
- Z-buffering for 100% perfect hidden line removal
- GDOS printer output for ultra-high-res printouts—even with dot matrix printers
- Load/Save 2D object templates
- Super Extruder Tool for building objects with holes in them (like fonts) and/or multicolor faces
- Custom palette/shading selector
- Illustrated tutorial written by a professional artist, includes 3D objects on disk

Mark Kimball's CYBERMATE™

The CAD-3D Animator.

Supports (optional) StereoTek 3D Glasses

Now, CAD-3D is a cinematic tool rivaling workstations costing thousands of dollars. This is the software that has been drawing the crowds at our trade show booths.

Using advanced Delta compression techniques, CYBERMATE transforms your 1 meg ST into a **TEN MEGABYTE frame buffer**. Store up to a thousand animation frames of 3-D objects (no matter how complex) in RAM and play them back at speeds up to sixty frames-per-second. That's 2½ times faster than any movie. Silken smooth!

Write animation MACROS

To make your animations unique and interesting, the system had to be **totally flexible**. So we developed a new "programming language" that allows you to:

- Play sound effects or music (created with the G.I.S.T.™ sound editor, on page 10)
- Change frame rates and looping sequences
- Change the color palette
- Load and run animations as "batch" files
- Splice in animations from multiple sources
- Call other macros

Using the tools, you can create digital "home movies," corporate logo animations, and much more. And the FUTURE DESIGN DISK is all you need to get started creating the next outer-space epic. What are you waiting for?

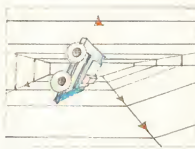
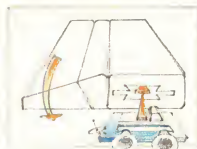
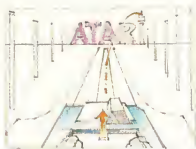
THE CYBER STUDIO

STEREO CAD-3D 2.0 plus CYBERMATE Available in February

2-disk set (requires 1 megabyte RAM)

ST0236 \$89.95

DEGAS Elite™ Batteries Included



CYBERSCAPE®

A 3-D "feature film" on disk by Darrel Anderson. Skim the fantastic, 3-dimensional terrain of the mind! Metamorphosing metallatons and transforming tubular time

slots! This full-color, animated feature was created by professional artist Darrel Anderson, to show what can be done with CYBERMATE—The CAD-3D Animator. An incredible tour

de force of computer graphic power, this demo is a guaranteed auto-lobotomy of the very first order! CYBERSCAPE DS (1 double-sided disk)

SB0104 \$10.00
CYBERSCAPE SS
(2 single-sided disks)
SB0105 \$12.00
(Both versions require
1 megabyte RAM)
Available in February

"A remarkably powerful modeling system."
—Computer Graphics World

The Original...

Tom Hudson's CAD-3D™ 1.0

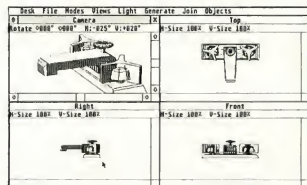
520ST-compatible

If you own a 520ST and are interested in computer graphics, many of the features of CAD-3D 2.0 are included in this original version—you even get a basic animation system.

CAD-3D 1.0

ST0214 \$49.95

(requires 512K RAM)



Introducing, for the first time, true 3-dimensional stereo realism on a home PC.
STEREOTEK 3D GLASSES

NEW!

STEREOTEK
 Three Dimensional Glasses



©Mazel Chernedoff/Tek West

Last July, we got a phone call from Tektronix, the big high-end computer-graphics display company. They told us one of their ventures, LC Technologies, had designed a low-cost version of their \$3,000 electronic stereo liquid crystal shutter (LCS) goggles—usually sold to the military and large universities. They were looking for a company to distribute them for the Atari ST. "Why us?" we asked. "Because the best software to make them work is CAD-3D."

From that conversation was born the most innovative computer graphics peripheral since the video display tube.

STEREO SOFTWARE AVAILABLE NOW

STEREO CAD-3D 2.0 and STEREO MAPS & LEGENDS 3.0 already work with STEREOTEK. And over a dozen new software titles are being readied for market right now. We have also included all the stereo C and assembler source code routines so you programmers can **write your own stereo software**.

Add the CYBERMATE animation system, and your CAD-3D movies become the ultimate in hi-tech computer graphics. Fleets of starships stream out of your monitor. Weird objects spin and fly through a thrilling new universe. Vivid MAPS & LEGENDS globes float in your lap—in amazing stereo 3-D.

Here's what you get with your STEREOTEK 3D GLASSES package.

- one pair of electronic LCS glasses w/4-foot cable (designed to also be worn over eyeglasses)
- ST cartridge interface unit—supports two sets of glasses at once (2nd set optional)
- stereo CAD-3D animation and slide show by Tom Hudson
- For programmers: developers instructions by Mark Kimball with source code on disk—teaches you how to add stereo to your own programs

STEREOTEK 3D PACKAGE TH9020 \$149.95
 ADD-ON GLASSES ONLY TH9021 \$99.95

COMPLETE STEREO PACKAGE—SAVE \$30!
 STEREO 3D STEREO DISPLAY with STEREO CAD-3D 2.0 and CYBERMATE TH9038 \$199.95
 offer available by direct mail only



FUTURE DESIGN DISK

by Darrel Anderson

NEW!

CAUTION! Don't enter the CAD-3D Universe unprepared. Get a fast start on your three-dimensional explorations with the CAD-3D FUTURE DESIGN DISK. This modular construction set of dimensional clip-art has **everything you need** to create SPACECRAFT, STATIONS, BASES, VEHICLES, ROBOTS and ANDROIDS.

Model your future; then populate it with androids and CAD-People; bring it to life with CYBERMATE; detail it



with any popular paint program. Includes:

- Complete models
- Component parts
- Construction tips
- "Blueprints"

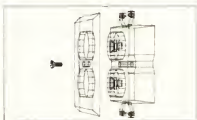
(requires CAD-3D)
FUTURE DESIGN DISK
 ST0232 \$24.95



PLOTTER AND PRINTER DRIVERS

Plot your 3D drawings on a high-resolution pen plotter for a truly professional look! Supports Hewlett-Packard (and HP compatible) plotters. Multi-plots on a single page—best fit system.

(requires CAD-3D)
PLOTTER DRIVERS
 ST0225 \$24.95



Also, dot matrix printers supported: GEMINI/STAR, EPSON, OKIDATA, IBM, COLOR (Radio Shack, Epson, Canon), NEC, PANASONIC, C-ITOH, and more.

\$5,000 CONTEST

Antic and LC Technologies are co-sponsoring a competition to search for the **MOST INNOVATIVE STEREO APPLICATION PROGRAM**. We're going to pay \$5,000 in cash (advance against royalties) for the winner, plus a continuing royalty upon publication here in The Catalog.

For an official entry blank and competition details, write to: STEREO COMPETITION; The Catalog, 524 Second St., San Francisco, CA 94107, or call (415) 957-0886.

3D-FONT PACKAGE

by Tom Hudson

Design your own 3D greeting cards, signs, logos, and letter-heads with CAD-3D. Or create sophisticated 3D animated title sequences for your home videos.

At the heart of this **packed** disk is Tom Hudson's new **SUPER EXTRUDER TOOL**. With it, you can create new kinds of complex, **multicolored 3D objects** that can't be built with CAD-3D alone. Plus, it doubles as a 3D FONT EDITOR, and Tom has built two **incredible fonts** just for you (serif and sans-serif, upper and



lower case)—over 250K of fonts!). **BONUS!** Tom's included new 3D object primitives (building blocks) and his own hints on how to get the most out of CAD-3D. (requires CAD-3D)
3D-FONT PACKAGE
 ST0224 \$24.95

NEW!

A-CALC PRIME™ by Kuma

Supercharged
by Kuma Computers, Ltd. UK

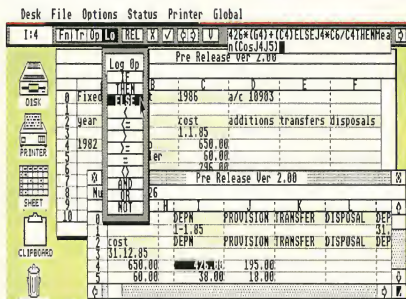
The first GEM-based spreadsheet for the ST just became the **best spreadsheet value on any microcomputer**. PRIME will give you the confidence to tackle **any** financial challenge. This is a next-generation spreadsheet with the power to run a large business—so intuitive **you already know how to use it**.

Features of the original A-CALC 1.0 made it the easiest-to-use spreadsheet ever:

- Up to five windows open at once
- WIDE-VIEW option to see 50 percent more of your worksheet at once
- SEARCH for character strings
- Powerful PRINTER FORMATTING commands
- .DIF file compatibility
- Exclusive A-CHART compatibility
- Sparse-matrix design maximizes available RAM

And now, PRIME transforms you into a **numbers wizard** with dozens of special features:

- Row and column lock
- Conditional expressions (IF, THEN, ELSE, etc.)
- MACROS
- Labels
- 8192 rows x 256 columns



"This is the easiest to use spreadsheet that I've ever seen."

—W. Krieger
Computer Shopper Magazine

- Color/pattern coding of formula, text, value, etc.
- SORT and FIND
- Trig functions
- Sideways printing (for Epson compatibles)
- High-speed SMOOTH screen updating
- Complete printer control from within the spreadsheet
- Password-protected cells (hide and unhide)
- Additional ease-of-use features:
 - Off-screen scrolling with the mouse
 - Out-of-the-way, convenient edit window
 - Cell and range reference by pointing with the mouse (even reference cells in inactive windows!)
 - Ten clipboards
 - Illustrated manual and on-disk examples

In short, PRIME gives you premium spreadsheet power for the rock-bottom price of \$79.95. And, for A-CALC 1.0 owners, the upgrade is only \$20.00 (plus \$5.00 shipping. Enclose your original ver. 1 disk).

A-CALC PRIME
ST0235 \$79.95
Available February

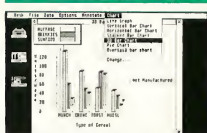
Make your next presentation the one they **remember**.

A-CHART™ by Kuma

NEW!

When was the last time you were excited about your spreadsheet? Do numbers bore you? We can change all that. A-CHART is one program that makes working with figures fun and intuitive.

A-CHART automatically turns your A-CALC (or A-CALC PRIME) spreadsheets into beautiful graphs that are DEGAS-compatible. And if you don't have a spreadsheet, A-CHART's **built-in** editor will help you organize those numbers into a super-sharp presentation.



A-CHART



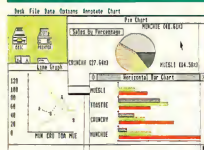
DEGAS ENHANCED

View your data in **eight different chart styles**—change styles instantly with one mouse-click. A-CHART sports what is probably the best use of GEM in any program. **Drag and size multiple charts** in each window, define your own fill patterns and line styles. The flexibility of the graphic presentation of your numbers will give you an **entirely**

new perspective on your business or home budget. And A-CHART grows as you do, with the capability of storing up to 50,000 datapoints in a 512K machine and 150,000 datapoints in a 1 meg machine.

A-CHART
ST0230 \$39.95
Available February

Epson-compatible from A-CHART.
Multi-printer compatible from DEGAS.



A-CHART



DEGAS ENHANCED

THE WORLD ON A DISK.
MAPS FOR EVERYBODY!

MAPS AND LEGENDS™ — The Cartographer

Enhanced Version 3.0
STEREO

by Harry Koons and
David Chenette

Hold on a second. Now that you've word-processed, spreadsheeted, databased and telecommunicated with your Atari ST, aren't you looking for something different?

How about Cartography? Until now, mapmaking has been a unique art mastered by only a few talented people. Not anymore. With MAPS AND LEGENDS, your Atari ST becomes a personal desktop cartography system.

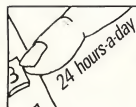
Show your children exactly

what the world looks like— with or without political boundaries. And in STEREO, the world globes appear



to be floating in front of your monitor. Or print an impressive custom map to go with your travel itinerary. We use MAPS AND LEGENDS all the time at the office for sales and marketing maps. And since it's based on the GEM interface, it's GEM-easy to use!

MAPS AND LEGENDS 3.0
ST0202 \$34.95
(upgrade is \$15)



800-443-0100, ext. 133

(Continental U.S. and Hawaii) Visa/MC Only

ORDER TOLL FREE

ARTIFICIAL INTELLIGENCE
Teach your ST, then let it teach you!

EXPERT OPINION™

by Mind Soft
Curious about expert systems and artificial intelligence? Discouraged because most expert systems tools are either for the IBM PC or Macintosh? And usually cost over \$700?

Transform your ST into an expert on any subject. EXPERT OPINION creates production-rule knowledge bases with more power than the average university system. And you don't need to know a programming language like Prolog or LISP—EXPERT OPINION is totally GEM-based...so you already know how it works.

Create your own expert

systems for classification of Horticulture, Animal Husbandry, Gemology, Medical diagnosis, Economics—any subject you want. Be a part of the first wave of knowledge engineers!

EXPERT OPINION'S "Inference Engine" solves problems three ways: **DEDUCTION** (forward chaining); **VERIFICATION OF A HYPOTHESIS** (backward chaining); or a unique combination of both modes. **CERTAINTY LEVELS** allow you to fine-tune your knowledge base with heuristic control. Plus, the clear, well-written documentation includes a tutorial by Harvard expert and START contributing editor Christopher Chabris.

LET'S-GET-TECHNICAL BOX

Packed with features, including: STEREO COMPATIBILITY, BUILT-IN 9000-COORDINATE DATABASE, 11 DIFFERENT MAP PERSPECTIVES, PLOTTING FROM ANY ALTITUDE, WORKS IN ALL 3 SCREEN MODES, BUILT-IN PAINT SYSTEM (and compatible with DEGAS and NEO), MULTI-FONT LABELLER, CUSTOM OVERLAY PLOTTER (create your own maps—build your own map databases), AUTO-LOCATE MODE (reads coordinates, distance and bearing from maps) and so many more that we don't have room to list them all.

DATAMAP COLLECTION I

Expand Your Maps and
Legends Database!

NATIONAL POLITICAL BOUNDARIES

Europe, Latin America,
S. America, Asia, Africa

PROVINCIAL BOUNDARIES

Australia, Canada, China,
U.S.S.R.

(requires Maps and Legends
2.0 or greater)

DATAMAPS
ST0227 \$24.95

PLUS HISTORICAL MAPS AND MORE!



FREE BONUS! To get you started, we've included a disk packed with knowledge bases about a typical application... Gemology. The six linked knowledge bases will guide you through the classification of over eighty kinds of rocks and minerals.

Perfect for studying how an expert system is built.

EXPERT OPINION
(2-disk set)

ST0219 \$99.95

WARNING: This is a sophisticated computer science tool requiring study to use it effectively.



**BEST
SELLER!**

POWERFUL SOFTWARE FROM BATTERIES INCLUDED



INCLUDED



ANYTHING THIS MUCH FUN IS USUALLY ILLEGAL.

NEW!

D.E.G.A.S. ELITE™

by Tom Hudson

The best-selling graphics software on the Atari ST just got ten times better! D.E.G.A.S. ELITE has all the power of the original, plus:

- 1) Multi-color fill patterns
- 2) Special effects like scaling, perspective distort, rotating, outlining, and color animation
- 3) Multiple screens in RAM at once (up to 8)—cut and paste between them
- 4) Color search and replace
- 5) Multiple GDOS or DEGAS fonts in any style available at any time
- 6) Polygon block grabber for lifting any section out of place
- 7) Stipling and smearing for real paintbrush effects
- 8) Load or save any resolution picture in any other resolution
- 9) Built-in icon editor for programmers
- 10) Color palette blending for smooth shading effects

**DEGAS ELITE
TH9036 \$79.95**



SAVE! GET THE COMPLETE PICTURE!

Between them, CAD-3D and DEGAS make the Atari worth owning."

—Jerry Pournelle
Byte Magazine

**DEGAS ELITE & STEREO CAD-3D 2.0
TH9039 \$149.95**



**INTEGRATED FINANCIAL
SOFTWARE FROM
BATTERIES INCLUDED™
THE ISGUR PORTFOLIO™**

THE ISGUR PORTFOLIO is three programs in one: Portfolio manager, telecommunications, and calendar/memo pad. Receive Dow Jones stock quotes, CompuServe, The Source, and InfoGlobe financial

information, automatically. Consolidate multiple stock portfolios. Hands on management of stocks, bonds, options, commodities, mutual funds—your key to financial success.

THE ISGUR PORTFOLIO is PC magazine's "EDITOR'S Choice." The integrated GEM-based system provides intuitive access to your data and unlimited versatility. A complete financial management package for the professional and individual investor.

A real value for your investment. Plus, **THE ISGUR PORTFOLIO** includes **1-S TALK**. Invest in your future... today.
TH9009 \$199.95

**BEST
SELLER!**



**A SPELLING CHECKER THAT
IS LIGHTNING FAST!
THUNDER™**

THUNDER gives you a powerful spelling checker accessible from within your favorite application program. Your accuracy will skyrocket, so the time spent proofing will plummet.

It's so simple. Here's how it works. Example: you're happily writing away and you make a "mstake" and BEEP (**THUNDER** picks up the error with lightning-fast speed). Now **THUNDER** will display a list of similarly spelled words (stake, mistake, etc.).

Compatible with Paperclip Elite, Homepak, BTS, other

Batteries Included products, 1st Word, GST-Edit, DB Master One, as well as FLASH, A-CALC and many more GEM software titles.

TH9011 \$39.95



**TAKE A SECOND FOR
TIME MANAGEMENT
TIMELINK™**

TIMELINK is a great GEM-based scheduling and time-keeping tool for home and business. Your day, week, month and year appointments are only a mouse-click away. Useful for messages, reminders and much more. There are many incredible uses for this handy elegant, time-saving tool.

TH9010 \$49.95

 **800-443-0100, ext. 133**
(Continental U.S. and Hawaii) Visa/MC Only
ORDER TOLL FREE

FFLASH is my #1 choice on the Atari ST."

—Ron Luks, Founder of CompuServe's SIG* Atari and Atari Developers Forum.

THE MOST POPULAR
TERMINAL PROGRAM FOR
THE ATARI ST.

FLASH™

Version 1.11

by Joe Chiazzese and Alan Page

If you own a modem, you should be using FLASH. Why? Because FLASH is the best. It will simplify your online time and make telecommunicating more enjoyable and less expensive.

TOTALLY PROGRAMMABLE PLUS BUILT-IN WORD PROCESSING

Imagine turning on your ST and, with one click from the GEM Desktop, beginning an online session on your favorite BBS. Watch FLASH

**BEST
SELLER!**

dial the number, log on, and automatically browse through the most recent messages or files. Then, edit some email in the built-in message editor, and upload it right from the capture buffer. Instantly! It's your personal telecom droid. So programmable that you have total control, and so GEM-intuitive that you feel right at home the first day you use it. No wonder FLASH is the most popular Atari terminal program of all time.

TERMINAL EMULATION PLUS BULLETPROOF FILE TRANSFERS

Of course, FLASH has a barrel full of terminal-emulation features, such as DEC VT100/VT52 and CompuServe Vidtext graphics, so you can use it with every mini or mainframe editor. And talk about

bulletproof file transfers! It's got the most reliable Xmodem around—never lose a file during transmission again!

PACKED WITH FEATURES! Here are just a few of the most useful features. Shop around and see if any other terminal program can even come close!

- Built-in GEM word processor with cut & paste
- Programmable "script" language (70 commands)
- Mainframe terminal emulation
- Xmodem (CRC), ASCII and DC2/DC4 file transfers
- Totally configurable to your needs!
- Free online time and membership

Ask your local telecom guru's opinion. FLASH is the winner... hands down!

FLASH
ST0220 \$39.95

FFLASH is to the Atari ST what Lotus 1-2-3 is to the IBM PC."

—Ken Wolburn

Microtimes Magazine

DOUBLE THE POWER OF YOUR FLASH! TRANSFORM IT INTO A BBS! ADD KERMIT!

REMOTE CONTROL ACCESSORY & KERMIT PROTOCOL™

by Joe Chiazzese and Alan Page

One mouse-click transforms FLASH into a password-protected BBS. You can send and receive files while you're in another room or even away from home!

Plus, you can now use the powerful KERMIT protocol with FLASH. With KERMIT, you can transfer up to 128 different files without touching your keyboard! More powerful than the version shipped with the Atari Developer's Kit—total automation for less than \$25!

Works with any Hayes-compatible modem.

(Remote/Kermit requires FLASH™)
ST0225 \$24.95

ALL THE FLASH COMMANDS ON ONE POP-UP CARD!

FLASH-CARDS™

The Ideal Flash Add-on Wouldn't it be great to have every FLASH command at your fingertips? This rigid command card lists all 110 of the commands, with their ALT-key equivalents. It slips right into your function key slot. Plus, it has room for you to write down three sets of



Start using FLASH-CARDS today!

FLASH-CARDS
TH9025 \$7.95

FREE! Try FLASH now and get \$15.00 of CompuServe access time, FREE.

Order now and you'll receive a CompuServe Intro-Pak; your free introductory subscription to the CompuServe Information Service with a 46-page CompuServe mini-manual. Plus \$15.00 worth of CompuServe access time, free.

This offer is valid for everybody, including current CompuServe subscribers.



MISSILE COMMAND™ MEETS SDI—WITH A TWIST. **RED ALERT™**

by Stanley Crane and Daniel Matejka

What if you could view a game of SUPER MISSILE COMMAND from space? You'd be playing RED ALERT! Your cities are under attack. Russian ICBM's and MIRV's are coming in—both over the pole and from subs. **You** make the decisions about where to locate your Antibalistic Missile Silos, Ground-based Lasers, and when to use your space-based Particle Beam Weapon. The **twist** is that you may also place your cities anywhere you want... from your hometown to Havana. Or use the European scenario and defend London, Paris and Rome from the Red Menace! **The perfect blend of strategy and arcade excitement.**

RED ALERT
ST0223 \$24.95

MISSILE COMMAND™ Atari Corp.

GET ORGANIZED AND HAVE FUN WITH MICHTRON

Eliminate the desk battlefield and make organizing easy!

CORNERMAN™

What Sidekick did for the IBM, **CORNERMAN** does better for your Atari ST. This utility gives you a host of useful desk-top tools in one simple, neat package. With everything from a built-in clock, notepad, phone book and ASCII table, to a full-function calculator, a

cluttered desk is a thing of the past. And as a desktop accessory, **CORNERMAN** is available nearly anywhere within GEM.

CORNERMAN doesn't interfere with other programs and comes complete with security. **HIRE THE PERFECT SECRETARY TODAY—HIRE CORNERMAN.**

(One megabyte RAM recommended.)
TH9013 \$49.95



Michtron



NEW!

Now you're organized—so take a break and have some fun.

PINBALL FACTORY™

Design your own pinball machines! Full-feature editor includes graphics line, circle, ray, box, textured fill, and more. Use your mouse to drag bumpers, borders and bells into position. Adjust the gravity, elasticity and speed. Save your creations to disk and build a whole arcade of pinball wonders!

TH9026 \$39.95

TIME BANDIT

BEST SELLER!

The arcade adventure takes you to the world of the biggest, fastest, most detailed game ever designed for a home computer. You're the bandit rogue travelling through time and space. The quest always beckons: recover the Great Artifacts and break the Gates of Time! Features: 16 unique arcade lands, 3,000 screens, realistic detail, three text adventures, unique dual-player mode. Uses 16 color monitor.

TH9014 \$39.95

WHY TRUST GYPSIES?

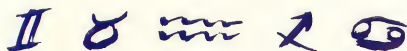
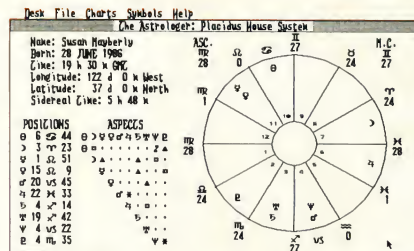
STAR STRUCK™ —The Astrologer

by Harry Koons

Sure, you can cross that palm with silver, but can you **trust** the results? Your ST, on the other hand, won't leave you in the gutter with empty pockets. And it's accurate! This GEM-based celestial workhorse **instantly** creates charts using formulas for the 9 most popular historical house systems (Placidus,

Morinus, Porphyry, and 6 more). And if you don't know the coordinates of your birthplace, just **point and click** on the US or world maps! Of course, you can save charts in DEGAS format and create your own **astro-masterpieces**. STAR STRUCK works in color or monochrome and comes with loads of extra fonts. Now you've got something to talk about at the local singles bar.

STAR STRUCK
ST0222 \$24.95



24 hours a day
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AT LAST! subLOGIC'S FLIGHT SIMULATOR FOR THE ST **FLIGHT SIMULATOR II™** *NEW!*

Buzz the World Trade Center—fly under the Golden Gate. You're going to love this one! We knew it was hot software the moment the prerelease copy hit the office. Whenever subLOGIC's **FLIGHT SIMULATOR II** was started up, a crowd of otherwise jaded programmers crowded around the computer station to watch. We finally had to take it away from them—nothing was getting done. **This is it.** The Atari ST version of the phenomenally successful **FLIGHT SIMULATOR II**. And it's really something.

Fly a Cessna prop plane, soar in a Lear jet, or dogfight with other planes in a World War I scenario. **Completely mouse controlled!** Multiple windows for multiple viewpoints: cockpit, spotter plane, tower, zoom-map—set up as many as you like, drag them, size them and put them where you want. Special custom-graphics routines permit multi-tasking windows. Explore accurate, solid, three-dimensional geographical scenarios which sweep by at update rates as high as 10 frames-per-second. Supplied scenarios include San Francisco, New York to Boston, Chicago to Champaign, Los Angeles, and Seattle.

RIVALS PROFESSIONAL TRAINING UNITS!

Two experienced pilots on our staff took **FLIGHT SIMULATOR II** up for a spin and pronounced it a complete success—detailed, accurate, in many ways far better than professional flight simulators. You can preset your position and altitude and adjust your seasonal and weather conditions—including wind direction and multiple cloud layers. Nine directional views are available from the cockpit **plus** a zoom and a pan. "Instant Replay" feature lets you redo your most successful moments—which you can then watch from any vantage point!

TWO-PLAYER MODEM FLIGHT!

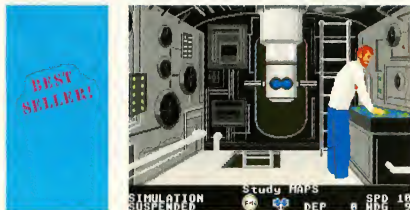
Spectacular two-player mode lets you fly with a friend over modem. Choose a distinctive color for your plane and you're

all set to stage your own aerobatic shows. Signal each other through the special text-message mode—or simply dip your wings. Our two in-house pilots hooked up a null-modem cable



and chased each other all over the San Francisco Bay Area, circling the Trans America Pyramid and buzzing Alcatraz. If you know someone with an Amiga version, you can take your rivalry to the skies!
FLIGHT SIMULATOR II
TH9027 \$49.95

subLOGIC



SILENT SERVICE™

Exciting World War II Submarine Action in the South Pacific!
by MicroProse

0400 hours, Tuesday, August 12, 1942... **BATTLE STATIONS!! BATTLE STATIONS!!** Enemy convoy identified on radar!

SILENT SERVICE, The Submarine Simulation, brings exciting action, great strategy, detailed graphics and an ultra-realistic simulation of World War II U.S. submarine action in the South Pacific.

SILENT SERVICE's outstanding features include: all the critical battle stations, engine room, conning tower and ship's bridge; challenging and realistic combat versus single ships and heavily escorted convoys; and an infinite variety of situations

using complete maps and charts for the entire Southwest Pacific and a sophisticated and realistic attack plotting system.

SILENT SERVICE provides a wide selection of historic scenarios. From hit-and-run attacks to patrol missions that bring challenge and fun to both the first time player and the experienced submarine veteran.

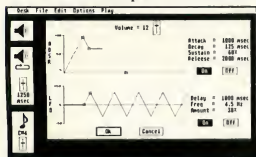
As captain, you select a quiet patrol sector in the Marianas Islands, or choose the dangerous waters off the coast of Japan. Is the submerged daylight periscope attack best, or do you charge in on the surface at night using only radar bearings as your guide? These and many more decisions will determine your place among the elite ranks of the **SILENT SERVICE**.
TH9016 \$39.95



CREATE NEAR-SYNTHESIZER-QUALITY SOUND EFFECTS WITH OUR **SOUND LABORATORY**.

G.I. Sound Tool G.I.S.T.™

by Lee Actor & Gary Levenberg for Synthetic Software
If **sound** has always fascinated you... or if you're a programmer or developer... take a look at G.I.S.T., the sound editor. G.I.S.T. was created to establish a standard of sound generation on the Atari ST that far surpasses the abilities of the built-in sound chip.



G.I.S.T.'s power is dynamic control of the GI chip. Each voice has three ADSR (envelope) controls and three LFO's (low frequency oscillators). You'll be creating sounds like a profes-

NEW!

G.I.S.T. is really two programs:
1) GEM-based editor
2) Sound Driver

As you can see from the screen display, the G.I.S.T. editor gives you real-time mouse control over any sound shape. The key to

sional engineer—Near Synthesizer Quality (NSQ) sound.

For programmers, the Sound Driver is linkable object code that can be used in your own software. Adding superior sound effects to **any** program... It's interrupt-driven, so it won't impact the speed of your software. In fact, it's already built into CYBERMATE for CAD-3D—just one of many useful applications.

LET'S-GET-TECHNICAL BOX

- Volume ADSR to shape attack, decay, sustain, release
 - Volume LFO for Tremolo effects and AM (Amplitude Modulation)
 - Frequency ADSR—frequency shifts up to ± 3 octaves!
 - Frequency LFO for Vibrato effects and FM (Frequency Modulation)
 - LFO delay lets you add effects at any point in the sound
 - Cut and Paste to copy part of one sound to another
 - MIDI-compatible! Use your keyboard to play the GI chip
 - Three sound windows may be open at once
- G.I.S.T. is also compatible with CYBERMATE. Add sound effects to your CAD-3D animations!

Source-compatible with Alcyon C, Megamax C, and Lattice C.
G.I.S.T.
ST0233 \$34.95
Available February



MORE POWER FOR PROGRAM DESIGNERS!

C.O.L.R. OBJECT EDITOR™

by The Rugby Circle
What is it? Originally designed to create the beautiful birds in ST Joust, C.O.L.R. OBJECT EDITOR is the original tool for making software sprites and bit-mapped game objects. Perfect for converting any piece of a low-res screen to a file linkable to your own C or assembly-language program.

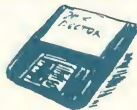
Use the powerful block-manipulation commands to create perfect images for your own programs. For example, design separate 360-degree views of a spaceship with CAD-3D, then cut each view out and link them together for your own space game. CAD-3D and C.O.L.R. OBJECT EDITOR are the **perfect** graphics team for every action programmer.
C.O.L.R.
ST0201 was \$29.95—on-sale only \$19.95
Joust™ Atari Corp.



FLOPPY DISKS AREN'T PERFECT. THAT'S WHY YOU NEED DISK DOCTOR.

DISK DOCTOR™

by Dan Matejka
The best time to get a good disk editor is **before** your un-backed-up disk is zapped by a power surge—or you mistakenly send your tax-return to the **trash can** instead of the backup disk in drive B.



DISK DOCTOR will make recovery of your lost data as painless as possible. You can even use its built-in GEM disk editor to personalize your own software's menus and error messages. DISK DOCTOR is the perfect file repair utility for casual users, plus it's one of a programmer's most valuable tools.
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CRYSTAL™

(It makes GEM shine...)

by Jim Thompson

These are the DOS Icons Digital Research forgot when they wrote GEM. It's too bad Atari didn't put CRYSTAL into

the TOS ROM's, because for about 30K of code, CRYSTAL gives TOS the most powerful features of MS-DOS. Plus, you never lose the look and feel of GEM. And since CRYSTAL is a desk accessory, it's always available.

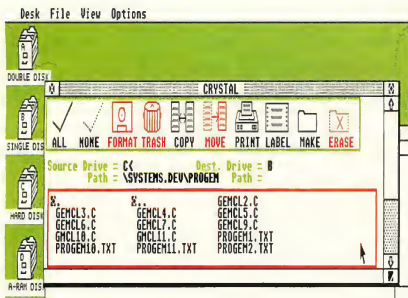
In fact, these eight icons will eliminate all the frustration you feel from not having powerful DOS functions available from within your favorite GEM program (or the desktop)...

Of course, CRYSTAL is compatible with all monitors,

all disk drives, and all printers.

Make your personal version of GEM shine—for \$24.95.

CRYSTAL
ST0229 \$24.95



ADD A WORLD OF DOS ICONS TO ALL OF YOUR GEM PROGRAMS.

- RENAME files singly or batch
- MOVE files in and out of subdirectories or to other disks
- COPY files
- FORMAT disks
- CREATE and DELETE folders
- TEXT FILE FORMAT and PRINT using headers, footers, and page numbers
- DISK LABELS printed automatically
- DELETE files

NEW!

TURN YOUR ST INTO TWO COMPUTERS!

K-SWITCH™

by Kuma Computers, Ltd.



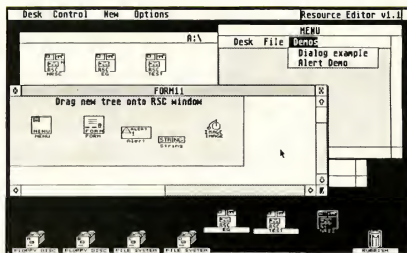
Picture this: You're in the middle of hyperwarp to an endangered sector of the Star Raiders™ galaxy when you hear the approaching footsteps of your boss. No problem. You press three keys and your ST instantly switches to IST WORD™ where you continue working on a letter to the Accounting Director. The boss's steps recede in the corridor... press three keys and—WHAMO! Right back in the middle of hyperwarp.

If you have a megabyte of RAM in your ST you can now load two programs at the same time. K-SWITCH splits your ST into two isolated 400K blocks, with a shared RAMdisk. You can toggle between two programs instantly—at any time. The inactive program will be frozen in progress, ready to continue right where you left off.

Now you can use your favorite word processor and database together. And for the ultimate in financial software, mate A-CALC PRIME and A-CHART, transferring data instantly with the RAMdisk. Even run low res. programs in one half, and medium res. in the other—it's a marvel to see it switch.

If you own a megabyte ST, K-SWITCH will transform the way you use it. Today.

(1 megabyte RAM required)
K-SWITCH
TH9023 \$29.95



Construct GEM resources without spending \$300 for the Atari Developers Kit.

K-RESOURCE™

by Kuma

Do you program in any of

- these languages? ■ C,
- Pascal, ■ Modula 2,
- Fortran, ■ Lisp.

Now you can write professional GEM programs with custom icons and dialog boxes—without spending an

arm and a leg. K-RESOURCE makes creating menus, icons, and screen dialogs easy. More powerful than the original DRI Resource Construction Set, K-RESOURCE is also compatible with all other .RSC files.

K-RESOURCE
TH9024 \$49.95

NOTE: Take a look at the ATARI ST GEM PROGRAMMERS REFERENCE from Abacus on page ST-15. It's the perfect companion to K-RESOURCE.

Here is the compiler that 1ST WORD™ was written in.

GSTC COMPILER™

by GST, Ltd.

If you've recently begun programming in C, this is the compiler you're looking for. Its GEM Superstructure

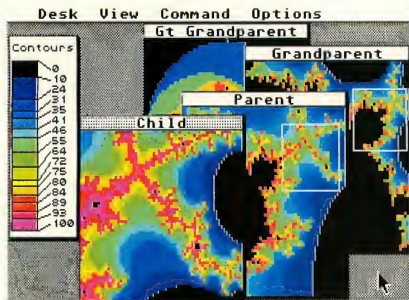
Library™ will make your very first program run with GEM windows—**automatically**. Write GEM applications without the complex learning curve associated with GEM AES and VDI. **Plus**, you don't

have to remember any arcane commands. The compiler and editor use GEM **everywhere**—it couldn't be easier!

The package includes a special programmers version of the GEM-intuitive 1ST WORD™

editor, Linker, C Compiler, 68K Assembler, GEM bindings (including XBIOS) and a comprehensive user manual.

GSTC
TH9018 \$79.95
1ST WORD™ Atari Corp.



LEARN GRAPHICS PROGRAMMING WITH GSTC!

GSTC APPLICATION/FOUNDATION I FRACTAL FACTORY™

NEW!

The best way to learn how to write a full-blown GEM application is by example. You need **source code**. FRACTAL FACTORY is a unique and beautiful program developed by the GST in-house programmers—and it's a **great tutorial**. It includes all the source code, batch files, linker files, graphics and math libraries—**everything** you need to build your own amazing ST program. **Plus**, FRACTAL FACTORY is the ultimate fractal-maker, using multiple windows, variable zoom, and contouring to display and save infinite generations of dazzling mathematical graphics.

(Does not require GSTC.)

FRACTAL FACTORY
ST0228 \$19.95

A high-level Macro Assembler with an unbeatable combination of price, performance, and features.

GST-ASM™

by GST, Ltd.

When you want to squeeze

that last drop of performance out of your ST, GST-ASM is the macro assembler that will get the job done. It's got everything... high-powered macro facilities and toolkit, extended macro functions, 100% Motorola compatibility, plus

the built-in exclusive GEM editor and GEM "shell" operating environment. In fact, it's probably the most elegant and sophisticated assembler available for **any** microcomputer. Naturally, it also creates cross-reference listings, symbol

tables, supports include files, generates relocatable code, and produces object files compatible with every high-level language.

GST-ASM
TH9017 \$59.95

Be the fastest assembly-language programmer around—for under \$35!

A-SEKA™ by Kuma

Version 1.6

by Andelos Systems/Kuma, UK 68K Assembler, Editor, Debugger, Disassembler. Sometimes you just need to tweak that code for speed. Or maybe you want to prototype an idea... fast. SEKA does it fast, because it's all in RAM. All of it. Source code assembles at over 30,000 lines

per minute! Plus it assembles and links simultaneously, so you can **run your code instantly**. Naturally, this macro assembler has a full-screen editor and uses standard Motorola mnemonics. But what really sets it apart is its powerful machine language monitor, **disassembler** and **symbolic debugger**. SEKA will pay for itself in the time you save on your very first project.

A-SEKA
ST0216 \$34.95

A-RAM™ by Kuma

by Roddy Pratt, UK

Can your RAMdisk partition any size disk emulator you want?

- A-RAM can.
- Can your RAMdisk **accelerate** your floppy write speed?
- A-RAM can.

A RAMdisk is an area of memory set aside as a buffer that responds like a disk

drive—only **much faster**. Everybody needs a great RAMdisk, and A-RAM is powerful, simple, and flexible enough for every application.

BONUS! Order now and we'll send you the **best** print spooler you've ever seen. Never wait for your printer again!

A-RAM & SPOOLER
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LATTICE C™

Here it is. The industry-standard C compiler for the IBM PC and Amiga is available now for your ST.

- Full Kernighan & Ritchie implementation
- Macros
- Complete interface to GEM libraries (all libraries included in object and source form)
- Compatible with linkers for Alcyon (DRI) and GSTC
- Includes MENU+ GEM shell operating environment
- Full floating-point arithmetic
- No runtime licenses required
- 270-page manual

If you're writing serious software, you need a lot of flexibility. LATTICE C has it: **PRE-PROCESSOR COMMANDS, STORAGE CLASSES, TYPE DECLARATORS, OBJECT MODIFIERS, INITIALIZERS, and STATEMENT TYPES.**

INCLUDES: EDITOR, LINKER, MENU+.

Compatible with G.I.S.T. (page 10)

LATTICE C

TH9007 \$149.95

MCC MACRO ASSEMBLER

by Metacomco

The MCC MACRO ASSEMBLER is the companion assembler for Lattice C and MCC Pascal. This full-specification assembler was specifically designed to complement those languages. Features include: linker, editor, GEM libraries, macros, MENU+ and 100-page manual.

MACRO ASSEMBLER

TH9005 \$79.95



Technical questions? Talk with a Metacomco System Software Engineer: Call (408) 438-7201.

MCC PASCAL™

ISO PASCAL COMPILER

A fast and powerful implementation of ISO PASCAL conforming fully to the exacting ISO 7185 standard. MCC PASCAL is the ideal Pascal for new or experienced users. Features include:

- Fast, single-pass compilation
- Compatible with ISO Pascal running on other macros
- 32-bit integer math plus 32-bit floating point
- Comprehensive error-handling
- Includes MENU+ GEM shell operating environment
- 215-page manual

INCLUDES: EDITOR, LINKER, MENU+.

ISO PASCAL

TH9006 \$99.95

NEW!

MAINFRAME ARTIFICIAL INTELLIGENCE ON AN ST? ABSOLUTELY!

CAMBRIDGE LISP™ 68000

LISP, the symbolic language of artificial intelligence applications, is now available on the Atari ST. LISP (LIST Processing) is the language of choice in the fields of robotics, expert systems, and natural-language interfaces.

CAMBRIDGE LISP 68000 was created in the same A.I. lab that developed the original LISP. Its authors, Cambridge University Professors John Fitch and Dr. Arthur Norman, have custom-designed a powerhouse, mainframe

language for your ST that supports all GEM AES and VDI calls.

Transform your Atari ST into a full A.I. workstation at the most outstanding price/performance yet achieved by a LISP system on any personal computer. And **CAMBRIDGE LISP 68000 is both an interpreter and a compiler.** Use the interpretive mode together with the trace package to quickly develop and debug programs. When all the diagnostics check out—compile it!

INCLUDES: EDITOR, LINKER, MENU+.
CAMBRIDGE LISP
TH9037 \$199.95

For an environment that's superb for development, I vote for Metacomco."

—Anita Sinclair,

Magnetic Scrolls, UK

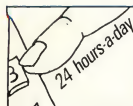
(developers of THE PAWN)

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We market a wider range of software than anyone in the ST marketplace. Whether you're a first-timer, veteran, or a major software firm, we have a place for you in The Catalog. We also distribute thru over 1,000 retailers. So, if you're looking for broad distribution and understanding support, send us your program and let us take a look. Worried about security? So are we. Just send us a description of your software and we'll arrange the necessary non-disclosure agreements.

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An Electronic Jewish Mother Created by a Former Playboy Cartoonist!

Written by Yakov Kirschen and Just For You, Inc.

MOM and ME™

Just think. Your own computerized Jewish mother—on-screen in an over-stuffed chair; knitting, cajoling, dispensing advice, and offering you encouragement—or making you feel guilty, of course. She'll speak to you by name and brag about you to your friends.

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MURRAY and ME™

Some people don't want a Jewish mother. How 'bout a Jewish uncle? The London Times called MURRAY "the first in a new generation of Biotoons!"—computerized, interactive cartoon characters. MURRAY is always ready to cheer you up when you're feeling blue.

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HARD TO FIND CABLES ONLY \$19.95



THE CATALOG has premium quality shielded cables with gold contacts.

What makes these cables so special? They have the unique non-standard Atari connectors and provide the length that can free-up your workstation

of awkward peripheral arrangements.

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6' ST Micro floppy disk drive cable (SF354 and SF314 drives)
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6' ST to printer cable
PH0001 \$19.95
5' ST to modem cable
PH0002 \$19.95

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10' Atari standard peripheral cable (Serial/SIO connector)
PH0006 \$19.95
5' 850 Interface to printer cable
PH0004 \$19.95
5' 850 Interface to modem cable
PH0005 \$19.95

ST ARCHIVES

START BACK ISSUES AND ANTIC COMPENDIUMS GET YOUR ST LIBRARY OFF TO A GOOD START! Back issues of START, The ST Quarterly are now available. You can order either the magazine, or the START disk—or both. Be sure and get them all now while we still have them in stock. (Issue #1 is in very limited supply. If you want that one, don't linger.) Magazines are only \$4.00 each, disks are \$10.95 (shipping and handling included).

	MAGAZINE #	DISK #
START #1	SMS0686	SDS0686
START #2	FALL '86	SDS0986
START #3	WINTER '86	SMS1286

AND—THE ANTIC ST RESOURCE COMPENDIUM
A complete collection on 3 1/2" disk of all the programs appearing in the ST RESOURCE section of ANTIC Magazine from the very first issue. Each disk is packed with example source code and runnable programs. \$10.95 each.

	ISSUES	DISK #
ST RESOURCE COMPENDIUM #1	8/85-1/86	SB0101
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ST RESOURCE COMPENDIUM #3	6/86-9/86	SB0103



"If you're familiar with Autocad for the IBM PC... you'll feel right at home with The Graphic Artist."
—Antic Magazine

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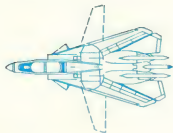
THE GRAPHIC ARTIST

This object-oriented drafting system features a unique spreadsheet foundation and menu-driven interface for beginning users. Complex macro-programming language offers complete control for professionals.



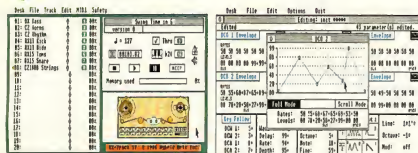
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Supports high-resolution dot-matrix printers, plotters, and laser printers. The two examples shown here were created by The Graphic Artist and were used to illustrate plotter output for the Autumn Catalog's CAD-3D plotter driver. Includes detailed 400-page manual, 2-disk set.
THE GRAPHIC ARTIST
TH9028 \$199.95



PROGRESSIVE COMPUTER APPLICATIONS

NEW!



The 20-track polyphonic MIDI recorder for the Atari ST.

EZ-Track™

This is the finest, moderately-priced MIDI software we've seen—and by an experienced firm with a strong music background. Easy to use, but no toy! With EZ-Track, you can make multitrack recordings in real time or step time, save them to disk, then play them back in perfect sync. Professional features include: Real-time solo and muting of tracks, quantizing (auto-correcting) of timing, instant transposition of entire song and much more. Memory capacity is over 27,000 notes on the 520ST and over 63,000 on the 1040ST—very flexible MIDI control.

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MIDI CABLES

High-quality MIDI spec. cables in 5 foot length.

TH9032 \$3.95 each

The patch librarian, editor and sound generator for the CASIO CZ synthesizer series and Atari ST.

CZ-Android™

Completely professional MIDI software designed specifically for your Atari CZ synthesizer. CZ-Android actually helps you program your CASIO CZ synthesizer. Then save thousands of your lush new patches with the 20,000-patches-per-disk librarian. Plus, you can edit all CZ parameters either graphically or numerically. The unique **Android programmer** lets you listen to thousands of new, original sounds and select the ones you like: to use right away, for graphical editing, or to save for later use. Get the most out of your instrument!

TH9031 \$99.95



The sheet-music printout program for the Atari ST.

EZ-Score™

This utility program translates EZ-Track song files into sheet music on the ST screen. You can then add lyrics and chord symbols as well as define the chart format. Most popular printers are supported.

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ABACUS BOOK 'n DISK PAKS

NEW!



ATARI ST TRICKS AND TIPS

Learn by example! This book contains a very important collection of ST programming tools and techniques, including: RAMdisk, print spooler, color print screen dump, and plotter output driver. Discover how to make brilliant graphic displays, use the VDISYS commands and master the powerful world of GEM applications, refine your BASIC, assembler and C programs with advanced programming techniques. 260 pages, single-sided disk.

TH9034 \$29.95

ATARI ST 3-D GRAPHICS

Learn ultra-fast 3-D graphics techniques in 68000 machine language. Teaches 3-D rotation, zooming, mathematics, and data structures. Topics include: transformation of one-dimensional figures to 3-D, hidden line removal, shading, and an introduction to 3-D computer-aided design. Features a 3-D patternmaker and animator. 351 pages, single-sided disk.

TH9035 \$34.95

ATARI ST GEM PROGRAMMERS REFERENCE

If you don't have the \$300 Atari Developer's Toolkit, you will need this indispensable guide for the serious ST programmer. Detailed information about GEM written specifically for the Atari ST in an easy-to-follow

format. Topics include: programming the VDI, AES, and GDOS, interfacing with TOS, how to choose the right programming language, and an introduction to C and assembly language. Includes a disk packed with example programs. 412 pages, single-sided disk.

TH9033 \$29.95

ST PUBLIC DOMAIN SOFTWARE

SOLID SOURCE CODE

Features Jim Luczak's VDI SAMPLER and C PRIMER, which demonstrates C programming techniques and the use of VDI functions and their C BINDINGS. BICALC, a desk accessory Binary-Hexadecimal-Decimal calculator. Plus two very fast versions of LIFE, written in Assembler.

PD0079 \$12.00

ARChive Collection

A collection of tools for manipulating archives—multiple files combined and compressed into single library files for later extraction and use. Includes TOS-based ARC, TTP (with generic C source code), ARC-SHELL (with full Modula-2 source code), a GEM-based front end program, and full documentation of the programs and their standard "ARC" file format, as used with the Amiga, MS-DOS, and Compuserve's Atari Forums.

PD0094 \$12.00

UNITERM—TEK/DEC Terminal Emulators

UNITERM, written by Simon Poole, is a public domain GEM-based terminal emulator supporting complete VT100 and Tektronix 4010/4014 modes (with zoom), as well as ASCII file-transfers and other features. Also included on the disk, both with full C source code, are WTERM II, a GEM-based Tektronix 4010 emulator that is compatible with Thunder! in terminal mode, and the XMODEM program for error-free downloads.

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ST BASIC/LOGO SAMPLER

BASIC: Includes MIDIREC.BAS—a simple MIDI sequencer and sample song files, BG.BAS—backgammon, Fractals in BASIC, Biorythm's, and more. LOGO: Nearly a dozen useful routines including complex graphics. Plus two bonus desk accessories.

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S/Terminal plus SOURCE!

PD0057 \$12.00

"Enhanced version with fill and palette functions."

ST DOODLE plus SOURCE

PD0058 \$12.00

XLISP

XLisp, written by David Betz, is a version of the LISP programming language on the Common LISP standard with extensions for object-oriented programming. Applications written in XLisp on the ST can be run as-is on many systems for which XLisp has been implemented, including Amiga, Macintosh, MS-DOS, CP/M-86, CP/M-68K, CP/M 2.2, VAX/VMS, and Unix. Includes 43-page manual and full C source code on disk.

PD0084 \$12.00

PROFF

PROFF is a text formatter similar to popular mini-computer tools like RUNOFF and TROFF. PROFF takes input from standard ASCII text files with embedded formatting commands and produces fully-formatted output files, including boldface and underlining effects that reproduce on any dot-matrix printer—just print from the GEM Desktop! Includes 37-page manual and full C source code.

PD0089 \$12.00

MicroEMACS Collection

MicroEMACS, originally developed by David Conroy, is a popular implementation of a useful subset of the EMACS text editor used on mini-computers. This disk includes an excellent version by Moshé Braner, with documentation and full C source code, as well as a version by Dan Lawrence that supports 40-line editing with the SM124 monochrome monitor.

PD0090 \$12.00

CAD-3D COLLECTION I

The first collection of complex objects created by Tom Hudson with CAD-3D. Includes: MONITOR (Atari SM124 monitor), ALPHOM (Alpha when viewed from one angle, Omega when viewed from another!) STARSHIP (Starship Enterprise), OUTLET (exploded view of electrical wall outlet), HELMET (16th century Japanese battle helmet), and more!

(requires CAD-3D ST0214)

PD0085 \$12.00

ST FRACTALS plus SOURCE!

Uses Mandelbrot algorithm to draw fractals in GEM windows in any resolution. Then zoom in with 2x, 4x, 8x, or 16x magnification. Change fractal iteration values and rescale fractals to enhance their color. Then save your fractal picture to disk. Includes all "C" source and object files. PLUS, a half dozen other fractal programs that use different algorithms and display techniques.

PD0068 \$12.00

ADVSYS

ADVSYS, written by David Betz, is a complete Lisp-like language for creating text adventure games. It offers special facilities for giving descriptions, parsing user-input sentences, and handling objects and actors. Includes complete docs on disk, as well as "Starship Columbus," a completely documented sample adventure that's also fun to play!

PD0092 \$12.00

SPELL/Writer's Tools

SPELL, written by Eric Bergman-Terell in Personal Pascal, is a simple spelling-checker for ASCII or 1st-Word files. It scans your document, reporting incorrect words and allowing you to add them to the program's unlimited-size dictionary.

PD0093 \$12.00

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