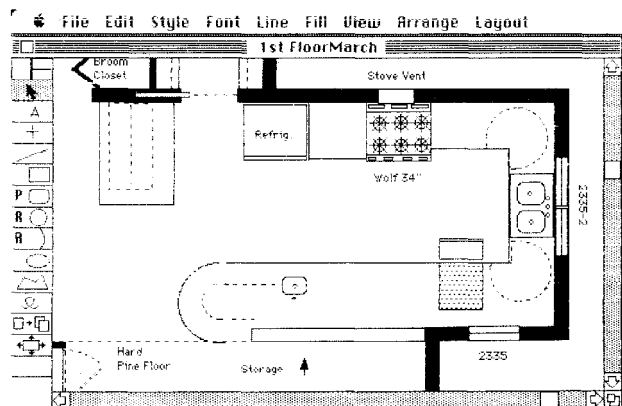


LOW-COST CAD

Drafting software costing from \$80 to \$800 can give you features and power once the domain of mainframe computers.



MacDraft offers easy, attractive sketching, but without precision. Here is a kitchen floor plan from MacDraft printed on the Apple Imagewriter.



BY BILL SMITH

Just as word processors have changed the way many people write, computer-aided design and drafting systems will probably change the way you draw. Switching from traditional drawing methods to computer-aided design, however, does have its complications. Besides the cost of the hardware and software, you can expect to spend quite a bit of time setting up the equipment and learning how to operate even basic CAD features. Mistakes and hardware incompatibilities are inevitable at first, so don't expect perfection on the first try. In all likelihood the system will slow you down rather than speed you up for at least a month.

Like any good power tool, it is difficult to become proficient with a computer-aided design system without a good deal of practice. As you gain proficiency, the benefits of CAD become evident. If you need to duplicate an object many times—whether it is a stud, a window, or an entire floor plan—one rendition is all that is necessary to make as many copies as necessary. When the client wants to make the inevitable changes to the plan, it is a simple matter to make the revision on the computer and produce a new plan—with no eraser marks. It is even a simple matter, with most programs, to produce an exact mirror image of a plan. And, if your plans evolve from standard details or from one another you can call up commonly used drawings, stored on disk, in a few seconds, and re-use or modify them.

If you get really good, you may find yourself making revisions on the computer while the client looks on. In the time it takes you to say, "Did you say you wanted to move this sink over here and move this wall over here?" you'll have the new drawing.

Features to Look For

As a general rule, the more features a program has, the harder it is to learn and use. Choosing a CAD program, then, is a balancing act between power and ease of use. The primary factor that influences a program's ease of use is how you give it instructions—the so called "user interface." In this area Macintosh software clearly outshines typical IBM-PC-based software. With "pull down" menus, and the ability to point to what you want the computer do do, Macintosh software allows you to work in a manner very similar to conventional drawing techniques. If you want a line in a particular place you can put it on the screen in less time than it takes to read this sentence.

A good user interface is one that you feel comfortable with. You are more likely to cozy up with a program that imitates conventional drawing techniques: allowing you to concentrate on the drawing and not on the computer. Typical Macintosh software, and PC software that imitates the Macintosh style, allows the user to get up and running with minimal effort or memorization. At the other extreme, AutoCad on the IBM PC offers a great deal of power and flexibility but with a cumbersome user interface and up to

a month of training before you are proficient. The trick is finding a powerful package that is easy to use. The ultimate combination of power and ease of use may be the version of AutoCad rumored to be in the works for the new large-screen Macintosh II. Unfortunately, spokespersons for AutoDesk, AutoCad's publisher, say there are no immediate plans for such a program.

It is crucial that you are comfortable with the device or devices used to create the drawing. For example, to create a drawing of a specific length, nothing beats the ability to enter 4 feet 6 inches—or some simple code like 4f6—on the keyboard. While some programs use a drawing pad or a joystick, nothing beats the speed of a "mouse"—a pointing device that is rolled around your desk.

Any good CAD system should allow you to draw at any desired scale, from 1 inch—100 feet to twice the drawn size and anywhere in between. You should be able to zoom in to work closeup or zoom out to see the big picture. By all means make sure that your program can pan in any direction, so you can scroll around the drawing in the zoomed-in mode.

You should be able to draw a full complement of objects: horizontal and vertical lines, diagonal lines, lines of various line weights, dotted lines, parallel lines, rectangles, circles, ellipses, arcs, polygons, and freehand curves. Ideally, you should be able to enter the exact length of an object and find any point on an object. Often it is very handy to be able to erase part of an object.

An "undo" feature can be a lifesaver. After spending hours toiling over a drawing you may discover that your latest keystroke completely messed up the drawing. If you can undo the last change, you'll return to the original state.

A CAD program should have the ability to dimension all objects: Some programs even offer "associative dimensioning," whereby the dimension number changes to reflect any changes in the object's size. For professional quality details, you should have the ability to annotate your drawings with text and arrows. Ideally you should have a choice of text sizes, styles, and typefaces.

Once drawn you should be able to move, rotate, and create a mirror image of an object. Mirroring can really come in handy after you've drawn one elevation and need to produce the opposite elevation: merely mirror the drawing and you're halfway there. Even more useful is the ability to change the size of an object. The ability to align objects, the tops of windows for example, can be a great timesaver.

If you plan to use a CAD system to speed up your drafting, make sure that there are pre-drawn graphic libraries available for the program. A graphic library of windows, doors, bathroom fixtures, and cabinets, for example, speeds the selection of products that both fit and look good.

If you intend to produce complex plans, you will find it very helpful for the program to have "layers." One layer can contain the basic floor plan, while another may contain the electrical, while another the plumbing. The separate layers can be viewed either separately or together, depending on your needs.

No matter how good a CAD system is, however, it is the quality of the output that makes the biggest impression. Most clients are impressed if they see that the building is drawn on a computer which, rightly or wrongly, many will assume is better than a hand-drawn building. Most CAD systems can send a drawing to a plotter which, with multiple colored pens and large E-sized sheets can cost upwards of \$10,000. On the other hand, you may be happy with A- or B-sized plotters that can cost less than \$1,000. If your drawings never have to be bigger than a legal sheet and you need near-typeset quality graphics, you may consider a laser printer. A laser printer would be particularly helpful to produce a book of plans or details. If your budget can't stretch to these levels, consider the dot matrix printer. The wide-body Apple Imagewriter connected to the Macintosh can produce a surprisingly good drawing for very little money.

Powerful computer-aided design and drafting (or CAD) systems, once the exclusive domain of expensive main-frame computers, are now available for affordable personal computers. What follows is a representative sample of reasonably priced CAD systems that run on the Apple Macintosh and MS DOS machines. ■

MacDraft

Innovative Data Design, Inc.
1975 Willow Pass Road
Concord, CA 94520

List Price: \$269, version 1.2a with large-screen support, not copy protected.

Requires: 512K Macintosh or Macintosh Plus.

Recommended: ImageWriter printer

Since most Macintosh users are familiar with *MacPaint*, it seems fair to compare *MacDraft* to *MacPaint*. *MacDraft* uses the comfortable Macintosh interface but is far more capable than *MacPaint* for drafting purposes. Unlike *MacPaint* which treats each object as a series of dots (or pixels) that are either on or off, *MacDraft* draws objects as distinct entities that can be resized and moved at will. *MacPaint* and other programs of the "painting" genre are great for artistic, freehand drawings; but are not particularly good for drawing buildings.

MacDraft offers a reasonable array of drawing tools, (although no double lines) and allows you to pan around the drawing with great ease. You may zoom in to very fine detail and zoom out to see the entire picture. As you draw, the program keeps track of an object's size in feet and inches. Depending on the zoom level and chosen scale, accuracy can be down to 1/512th of an inch, but this can be annoying if all you need is accuracy to the nearest half inch. The program can handle virtually any scale. You have to remember to set the scale at the start of a drawing session whereas other programs make you choose a scale before starting.

MacDraft takes full advantage of the Macintosh's ability to create fill patterns: you can choose between 64 different patterns. Although you can edit those patterns to approximate insulation, shingles, clapboards, concrete and so on, the programmers show little

appreciation of the needs of a building designer. Edited patterns only stay with the particular drawing and do not alter the default patterns. (You can get around this limitation by setting up a drawing template with the edited patterns that you like.) Lines can be any of nine widths and dashed, and you can convert any line to an arrow or a dimension line.

Drawings can be any size up to four feet square. Unfortunately there is no direct plotter support. However, a separate program, *MacPlot*, can be added to the system, to support a plotter. If you rotate the drawing and instruct the computer to print across the page perforations you can produce surprisingly good drawings on Apple's wide body Imagewriter printer—13 inches wide by as long as necessary. If you need drawings that are two feet tall it is a fairly easy task to tape two pieces of paper together and produce a large velum original.

MacDraft's designers clearly believe that drafting is a graphic activity: visual clues appear throughout the program. Whenever you click on an object (move the mouse's pointer to an object and push the mouse button) small boxes or "handles" appear on the object's corners. If you then click directly over one of these handles, you can easily resize the object and *MacDraft* displays the new dimensions as you go. If you click on the object itself, a small triangle appears, giving you the clue that the object can be moved anywhere merely by moving the mouse. In addition, it is possible to rotate any object with one degree increments.

Erasing a part of an object, however, is tricky compared to *MacPaint's* "eraser." First you must create an object filled with the white pattern (to match the screen's color) with invisible lines. That invisible object can then be moved anywhere and will erase any part of an object it overlaps.

A price is paid for this wonderful ease of resizing and moving. Often it is difficult to get the exact size you want and it is difficult to move objects precisely where you want. *MacDraft* is very easy to use on the surface; and it offers many powerful features. However, to get the precision that is necessary for a house plan requires many hours of tedious work. If the programmers merely added the ability to enter specific object sizes and positions, it would get my vote as the program with the best mix of power and ease of use. As it stands now, it is very handy for sketching out plans or elevations, but without specific length entry from the keyboard, it takes a long time to get it just right for final drawings.

MiniCAD

Diehl Graphsoft

3246-K Normandy Woods Drive
Ellicott City, MD 21043

List Price: \$495, version 3.0

Requires: 512K Macintosh or Macintosh Plus

Recommended: Imagewriter printer

MiniCad is the only true CAD system for the Macintosh that follows the normal Macintosh interface. It looks and feels a lot like *MacDraft*, has most of *MacDraft's* features, costs twice as much, and offers a lot of extra features relevant for the builder or designer.

Perhaps the most important feature *MiniCad* has over *MacDraft* is its ability to create multiple layers (16 on a 512K Mac, 40 on a 1-meg Mac Plus). You can create the basic first-floor plan on one level, put furniture on another, electrical on a third, plumbing on a fourth, and the second floor plan on a fifth, for example. It is then an easy process to show or print any combination of layers in perfect registration.

Until very recently a 3D drawing program with mediocre 2D abilities, *MiniCad* has been completely revamped to include a sophisticated 2D CAD system integrated with a decent 3D drawing program. Now you can have your cake and eat it too: by assigning the second floor a "depth" of eight feet above the first floor, you can "extrude" a 3D view of the first and second floor plans and rotate it to any perspective view.

The zoom capability is truly amazing: you easily can pick any section to zoom in on any part of the drawing until a section is enlarged over 1000 times. At any magnification, lines are only one pixel (screen dot) wide, not nearly so obvious. Also *MiniCad* doesn't offer a normal Macintosh scroll, but it does provide a "hand" that allows the designer to drag the page around the screen as one would move a piece of paper on a desk.

Any object can be edited or created with the mouse or the keyboard. For rough sketches the mouse provides a very quick line, double line, rectangle, circle, arc, polygon, or freehand line. When a precisely sized object is needed, it is possible to enter the width and roughly with the mouse or precisely by entering the numerical location on a grid. In very short order, you will wonder how anyone can draw detailed, scale drawings on a computer without these features. Any size object can be thrown into a drawing and exactly resized while simultaneously locating it. In addition, an object can be "snapped" exactly adjacent to another object, which saves a great deal of time—for

example, when one edge of a framing member needs to be aligned exactly above another.

Like *MacDraft*, a full complement of editable fill patterns are available, with many suitable for building details. Like most Mac drawing programs, you click on an object to move or edit it. Erasure is also easy! There are numerous ways to separate out a section of an object for deletion. Conversely, *MiniCad* allows you to combine any number of objects to create one new object.

Another major feature is *MiniCad's* ability to create a library with up to 32,000 object symbols. Any object or group of objects (such as specific doors, windows, sinks, cabinets, or cookstoves) can be saved and pulled into any drawing at any time. If any changes need to be made to a symbol, it is an easy matter to edit the symbol and simultaneously alter any instances of that symbol.

Dimensioning is handled particularly well: once a line is selected with the mouse, you merely choose the appropriate dimension command from a pull down menu. Instantly, witness lines extend from the ends of the object, and a double headed arrow extends between the witness lines with the exact length. Like *AutoSketch*, if the object is resized, the dimension number is automatically adjusted.

About the only major feature missing from the *MiniCad* package is the lack of direct plotter support, although this can be added to the system with *MacPlot*.

The manual provides detailed and clear descriptions of each of the program's features, although the organization of commands is somewhat confusing. In short, this is one nice piece of programming. It gets my vote as the best combination of power and price.

MGM Station

Micro CAD/CAM Inc.
3230 Overland Avenue
Los Angeles, CA 90034

List Price: \$799, version 2.05 copy protected.

Requires: 512K Macintosh or Macintosh Plus

Recommended: Hard drive, Imagewriter printer, and plotter.

MGM Station (for Micro Graphic Manufacturing Station) bills itself as having *AutoCad* power on the Macintosh. Although *MGM Station* does offer an impressive array of features it does not quite match all of *AutoCad's*, but can be purchased for almost one-third the price.

MGM Station offers an extensive choice of drawing tools and allows the designer to precisely place and size an object. However, the programmer's desire to cover every conceivable type of line or object makes it difficult to get to commonly used objects. Although this difficulty is common in the MS DOS world, on the Macintosh one longs to be able to simply draw a line from one place to another. On *MGM Station*, you first have to point to the beginning of the line, then choose the type of line from a pop-up menu (on the left side of the screen!) then type in the length, then point to the desired direction. It's extremely accurate, but you don't always need that kind of accuracy. Negotiating the 122 commands and more than 15 menus is somewhat cumbersome at first and takes some getting used to. In short, *MGM Station* is much more number oriented than most Macintosh programs which are more graphically oriented.

MGM Station offers lots of features that are not particularly relevant for building design but handy nonetheless. It really excels as a front end for designing machine parts. However, once you've gotten up to speed with this program, it is possible to quickly produce precise, professional drawings of any type. *MGM Station* allows you to save a drawing as a "symbol" that can be included in any drawing with great speed.

Many of *MGM Station's* graphic functions force the user to know the numerical location on a grid for the start and/or end of object. This is awkward for the building draftsman who is much more concerned with the distances between and amid objects.

Unlike most Mac programs, *MGM Station* does not offer scroll bars, unless you specifically ask the program to display them. After a short delay scroll bars are presented but you lose access to any of the drawing tools. All you can do is scroll around the window.

Unlike *MacDraft* or *MiniCad*, it is surprisingly time consuming to move an object, although great precision is possible. In addition, it is impossible to change the size of an object without redrawing the entire object. In general, *MGM Station* is less intuitive than simpler Macintosh drawing programs.

Although the manual does present a minimal explanation of what each feature does, it offers little explanation about how to use each feature. A short tutorial is hidden at the end of the manual and it does a barely adequate job.

MGM Station allows you to choose between a wide choice of plotters. Although the program does take some getting used to, it offers a powerful array of features, extreme accuracy, and professional quality output.

AutoSketch

Autodesk, Inc.
2320 Marinship Way
Sausalito, CA 94965

(415) 331-0356

List Price: \$79.95.

Speed enhanced version: \$99.95 not copy protected.

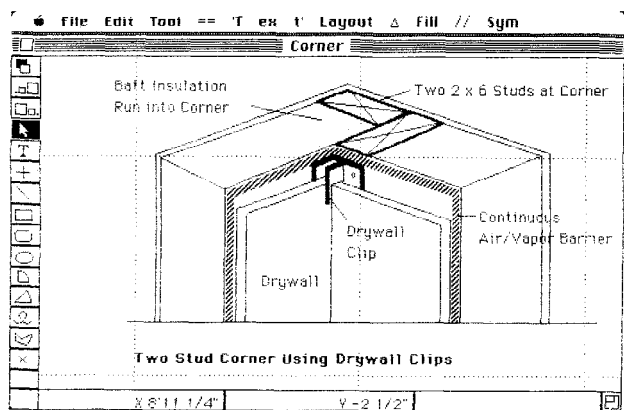
Requires: 512K RAM, 2 floppy disk drives, DOS 2.0 or later, Hercules Graphics card, or IBM Color Graphics adapter or IBM Enhanced Graphics Adapter (with 256K graphics memory and Enhanced Graphics Display).

Recommended: Microsoft Mouse or compatible. Koala Pad, joystick, or Autodesk Device Interface pointer.

Published by Autodesk, developers of the powerful and expensive *AutoCad*, *AutoSketch* is an entry level drafting program lacking many features but is surprisingly good for its price. If you doubt the value of plunking down \$2500 to \$2800 for *AutoCad* and spending weeks learning the program, *AutoSketch* provides just enough to whet your appetite and yet remains compatible with its big brother.

Intended to be a basic drawing tool, it is too slow for professional use. *AutoSketch* distinguishes itself from other programs of its genre by being easy to use, affordable, and having a respectable number of features.

AutoSketch is modeled after the Macintosh interface, complete with pull down menus and dialog boxes. And like many Macintosh programs it is possible to use *AutoSketch* simply by following the on-screen instructions. Although the program does allow drawing with just the keyboard, a mouse is



With layering and other sophisticated capabilities, *MiniCad* qualifies as the only true CAD system for the Mac. It's used here to show the layout of a two-stud corner.

almost essential.

AutoSketch offers a basic but adequate complement of drawing tools. After a short while with the program it is apparent that the program, although simple, is very well designed. *AutoSketch* illustrates the talent of Autodesk programmers to fit such a good program into such a small package with a remarkable price. If you have an MS DOS machine you can try out a drafting program with a minimal expense.

AutoSketch does lack some features, which is not surprising at \$79.95. It has no parallel lines, wide lines, arcs, regular polygons, free-form sketching, or patterns. In addition, there is only one text style and you can specify only its starting point. However it has one remarkable feature even *AutoCad* lacks: if you link a dimension line to an object and then change the size of the object, the dimension line changes automatically.

On balance, *AutoSketch* is a very good value. Although many people will find the program to have limited features and lackluster speed, data files are upwardly compatible with *AutoCad*.

In-A-Vision

Micrografx, Inc.

1820 N. Greenville Ave.

Richardson, Texas 75081

(214) 234-1769

List Price: \$495.00. Not copy protected.

Requires: 320K RAM, 2 floppy disk drives, DOS 2.0 or later, Hercules Graphics card, or IBM Color Graphics adapter or IBM Enhanced Graphics Adapter (with 256K graphics memory and Enhanced Graphics Display).

Recommended: 512K RAM Microsoft Mouse and Microsoft Windows.

In-A-Vision is a complete simulation of the Macintosh on MS DOS machines down to fine details. The drawing screen is remarkably similar to *MacDraft*, complete with scroll bars, pull-down menus, rulers, and a mouse-controlled pointer. To move or alter an object, one merely clicks on the object and small "handles" appear. These handles can be used to stretch or move the object.

A standard set of drawing tools are available from pull-down menus or from the keyboard, including straight and diagonal lines, rectangles, circles, and arcs. But no double lines. Although there is no Mac-like graphic tool palette, you are reminded which drawing tool you are using by a graphic symbol: for example, a pencil is used to represent the line-drawing tool.

There are nowhere near the number of fill patterns or typestyles available on a typical Macintosh program, but this is due to limitations in the hardware, not the software. Type can be placed anywhere on the screen. Unfortunately, crucial features such as rotation and dimension lines are missing.

In-A-Vision allows the designer to choose either A-, B-, C-, D-, or E-sized paper for output. Although a variety of dot-matrix printers and laser printers are supported no plotters are supported.

Like *MacDraft*, it is not a true CAD program, as there are no layers nor the ability to enter distances from the keyboard. It does offer more flexibility than *AutoSketch* but at substantially greater price. Although it purports to be operable with just the keyboard, a mouse is essential for any serious work. ■

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