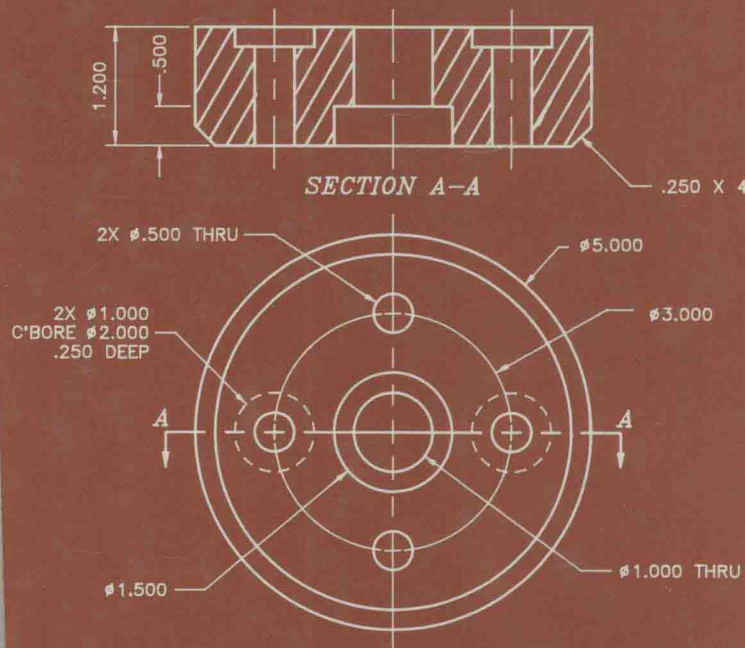
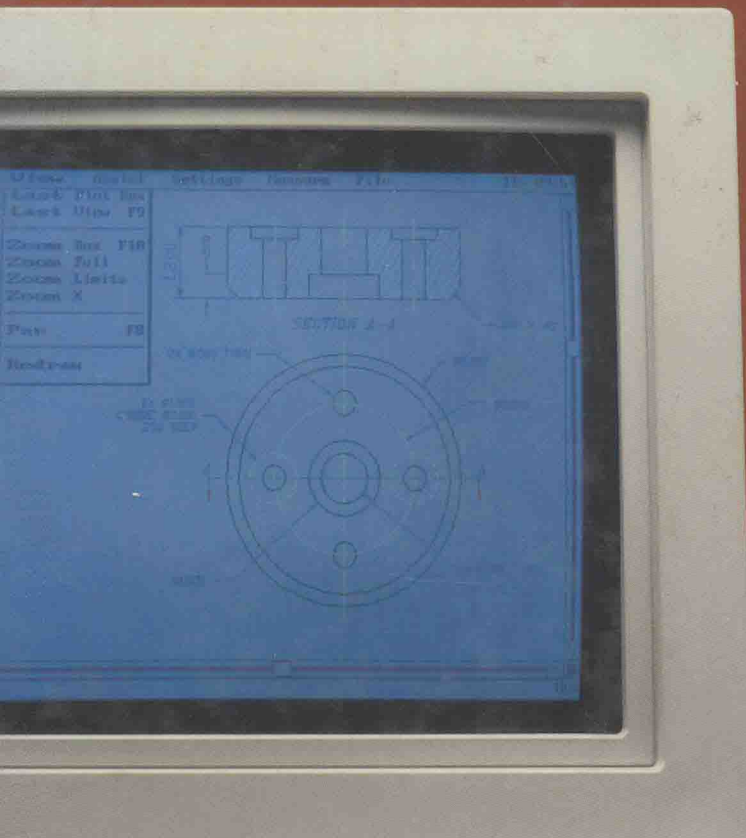


Versions 3 and 2.0

# AutoSketch

for Drafting and Design

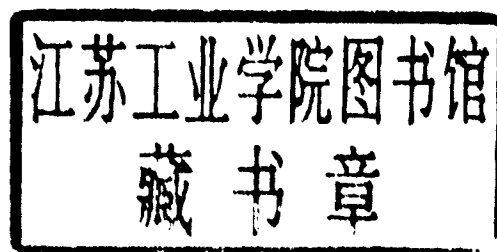
Brian L. Duelm



# **AutoSketch** **for Drafting and Design**

by

Brian L. Duelm



South Holland, Illinois

**THE GOODHEART-WILLCOX COMPANY, INC.**

**Publishers**

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by

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# INTRODUCTION

AUTOSKETCH FOR DRAFTING AND DESIGN is an innovative text written to help you learn the application of AutoSketch for drafting and design tasks. In addition to completely covering AutoSketch, the text also covers the hardware, practices, and technical language of computer-aided drafting and design. It will make your transition from pencil and drafting board to computer much smoother, and more enjoyable.

This text is a valuable resource for anyone interested in using AutoSketch for drawing, design, and technical illustration. Readers who are preparing for a career as a CAD drafter or designer will find this text to be a valuable part of their studies.

The topics in AUTOSKETCH FOR DRAFTING AND DESIGN are covered in an easy-to-learn sequence, and progress in a manner that allows you to become comfortable with the commands as your knowledge builds from one chapter to the next. In addition, this text offers the following features:

- Step-by-step use of AutoSketch's commands.
- Detailed explanations of how and why the commands function.
- Tips on how to use AutoSketch effectively and efficiently.
- Review questions at the ends of the chapters to review the commands and concepts.
- End-of-the-chapter activities allow you to apply the commands discussed in the chapter.

AUTOSKETCH FOR DRAFTING AND DESIGN not only allows you to learn AutoSketch commands, but also makes you familiar with:

- Hardware used with AutoSketch.
- Benefits of computer-aided drafting and design.
- Care of removable disks.
- Coordinate systems used by AutoSketch.
- Line types and their uses.
- Editing operations that increase productivity.
- Accepted dimensioning techniques and practices.
- Plotting and printing drawings.
- Using MS-DOS commands.

**Brian L. Duelm**

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Datagraphic Systems  
Fairchild Space Company  
G. Bart Stryker

GMD, Inc.  
Hearlihy & Co.  
Houston Instrument, A Division of Ametek  
Intergraph  
International Business Machines Corporation  
Logitech  
Seagate  
Spectragraphics  
Tallgrass Technologies  
Twin Disc

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# USING THIS TEXT

What makes this text important? How is it different from the *AutoSketch Reference Manual*? These are typical questions you might have upon opening this book. Probably the most important response is that this textbook teaches you how to apply AutoSketch to typical drawing tasks. It leaves information on installing hardware and connecting cables to the AutoSketch documentation where it is described in detail. This allows room for topics on drafting, expressing your design ideas, and getting the most out of AutoSketch. There are plenty of drawing exercises to help you develop your skills.

AUTOSKETCH FOR DRAFTING AND DESIGN introduces AutoSketch commands in the order you might need them. It is not arranged in alphabetical order or in the order of menus. The book assumes that you have very little knowledge of computers or the AutoSketch software. The topics follow a step-by-step approach, and each chapter builds on the previous one. Thus, it is best to proceed through the chapters in order. The text also presents topics on drafting in the same way you would learn traditional drafting instruction. Each chapter shows how to apply AutoSketch to typical drawing tasks.

Each chapter begins with learning objectives and an overview. Review the objectives so that you know what important topics to look for in the chapter. Refer to the illustrations as you read the text. Each one points out an important feature of AutoSketch or a drafting practice. As you learn AutoSketch, you will also learn skills required by industry. If you have access to an AutoSketch system, work through the commands as you read.

Different type styles are used to define terms. **Bold words** usually indicate an on-screen menu, command, or dialogue box of AutoSketch. Examples are the **Draw** menu and **Line** command. AutoSketch terms in *italics* point out information you must enter in dialogue boxes. Terms in brackets [ ] refer to a key on your keyboard, such as the [Alt] key. Single lines in special type, such as:

Line Enter point:

Refer to messages AutoSketch gives on screen. Look for these as you work through the chapters. New technical terms are always printed in *italics* and immediately defined. These terms are then listed at the end of the chapter for your review. The index shows the page number of important terms in italic type, and the commands.

Each chapter concludes with review questions and carefully selected activities. Review questions test your comprehension of the chapter topics. Activities include drawing exercises in which you apply learned skills on an available AutoSketch system. If a computer and AutoSketch are not available, sketch the exercises in pencil and write down the commands you might choose. Then, when you are able to use a system, work through the activities on screen. No part of AutoSketch is impossible to learn, but you will need time at the computer to practice.

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# Chapter 1

## INTRODUCTION TO DRAFTING AND CAD

After studying this chapter, you will be able to:

- Explain how drawings help document an idea.
- Describe how computer-aided drafting is different from manual drafting.
- Identify the different fields of drafting and graphic design.
- Specify the hardware that makes up a CAD system.
- Recognize the different drafting positions.
- List the qualifications you should have to be a CAD drafter.

### INTRODUCTION TO DRAFTING

*Drafting* is a language, a method to communicate ideas with drawings. Most products you see around you began as a sketch on paper or a computer screen. Completed *working drawings* convey the information other people need to build, machine, assemble, install, or service a product, Fig. 1-1. Drafting applies to the hobbyist and homeowner as much as it does to industry. If you want to design a new basketball backboard, a good way to show your ideas is with a drawing.

Why draw rather than give written or spoken directions? One reason is because words cannot describe everything. Have you ever tried to give someone directions to a place, only to have the person get lost? Your directions may have been accurate, but words mean different things to different people. A simple sketch on scratch paper may have solved the problem. A well prepared drawing does the same thing; it conveys a single product idea that should not be misunderstood.

In this text, you will learn that drafting is a universal language. Lines, measurements, notes, and symbols describe the size, shape, material, finish, and assembly of a product. Using standard symbols and measurements means that drafters in California can interpret the drawing the same way as drafters in New York. *Standards organizations* set the



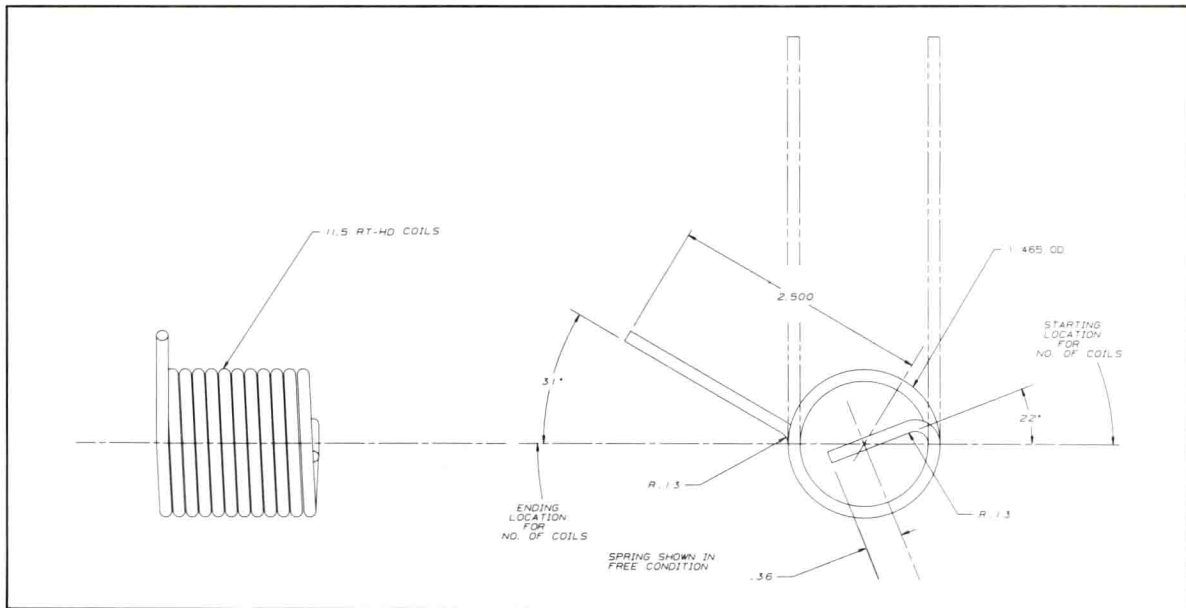


Fig. 1-1. This working drawing provides the information needed to manufacture a spring. The part will be installed in a satellite. (Fairchild Space Company)

guidelines that companies should follow to prepare their drawings. Two such organizations are the American National Standards Institute (ANSI) and International Standards Organization (ISO).

## WHAT IS CAD?

To understand computer-aided drafting, you should first know a little bit about manual drafting. *Manual drafting* is the process of creating a drawing on paper using drafting instruments. These tools include: a pencil, T-square or drafting machine, scale, dividers, compass, eraser, erasing shield, French curve, and triangles. Some of these are shown in Fig. 1-2. By handling these tools, you can draw accurate straight lines, circles, arcs, and curved lines.

*Computer-aided drafting (CAD)* is the process of creating a drawing on screen using a computer and drawing software, Fig. 1-3. AutoSketch is a product of this new technology—the use of personal computers for drawing and design. Companies are replacing their pencils, drawing boards, and scales with personal computers and CAD software. These new tools help drafters prepare drawings quicker and more accurately. The key word is *help*. No CAD program, including AutoSketch, can create a drawing by itself. The process of drafting still requires the knowledge and experience of the drafter.

## Benefits of CAD

You might ask “What makes CAD so much better than manual drafting?” Here are several answers:

1. It is simply easier to draw objects using the computer. A manual drafter must create all images by moving a pencil. With CAD, you enter a command and one or two points. For



Fig. 1-2. Typical manual drafting tools—board, scale, triangle, pencil, and eraser.  
(Hearlihy & Co.)



Fig. 1-3. Computer-aided drafting workstation.  
(Houston Instrument)

- example, to draw a circle just choose the **Circle** command, pick the circle's center, and pick one other point. Drawing circles, lines, and other objects is discussed in Chapter 4.
2. You never draw the same shape twice using the computer. With manual drafting, you must draw identical shapes one at a time. However, with AutoSketch you simply choose the **Copy** command, pick the objects to copy, and place as many copies as needed. Copying objects is discussed in Chapter 6.
  3. A CAD drawing is more accurate and readable. It is more accurate because the computer stores the drawing in very precise computer code. The drawing is more readable because you cannot smear or tear a drawing stored in computer memory. This can happen to a paper drawing. Also, the CAD system outputs perfect line widths on paper. Outputting drawings from memory to paper (called *plotting*) is discussed in Chapter 14.
  4. Revisions are often made to a drawing. Editing a drawing on paper is time consuming. You have to tape the drawing to the drafting board, erase the mistakes, and draw the changes. With CAD, the drawing can be changed on screen easily. Editing drawings is discussed in Chapter 6.
  5. A CAD system improves communication. The drawing can be stored in a main computer, called a *server*, where different departments can access it through a network. A *network* is simply a connection of individual computers. Communications also improve when a company standardizes drawing practices. The drafting department supervisor may set up a model drawing, called a *prototype drawing*. This prototype drawing has a border and a title block. It is set up with the proper text size, linetypes, and standard symbols. All drafters within the drafting department begin their own drawings on this prototype drawing.

## DRAFTING, DESIGN, AND THE APPLICATION OF COMPUTERS

Every person who has reason to draw is a candidate for CAD. Each year, people find a wider spectrum of applications for computers. Any drawing done manually can be drawn faster and more precisely using a computer and CAD software. Applications described in this section cover only a few of the many areas where you might use AutoSketch or other CAD software.

### Technical Drafting

*Technical drafting* includes preparing drawings for manufacturing, construction, electronics, and land development, just to name a few.

**Mechanical drafting.** *Mechanical drafting* involves making drawings that describe the shape and size of manufactured products, Fig. 1-4. The product could be simple (a hinge) or complex (a lawn mower). Mechanical applications were the first use of CAD and remain the most prominent. Most companies have found that replacing manual drafting tools with computers makes drafters two to three times as productive.

In many industries, the CAD system is connected to a *computer-integrated manufacturing* (CIM) system. A CIM system controls manufacturing machinery and the production of products with computers. The CIM system uses the data stored in the CAD drawing as the basis for the manufacturing process. This data is stored in the engineering database and is used by many departments, Fig. 1-5. A CIM system speeds the manufacturing process, reduces costs, and improves quality.

### 1-4 AutoSketch for Drafting and Design



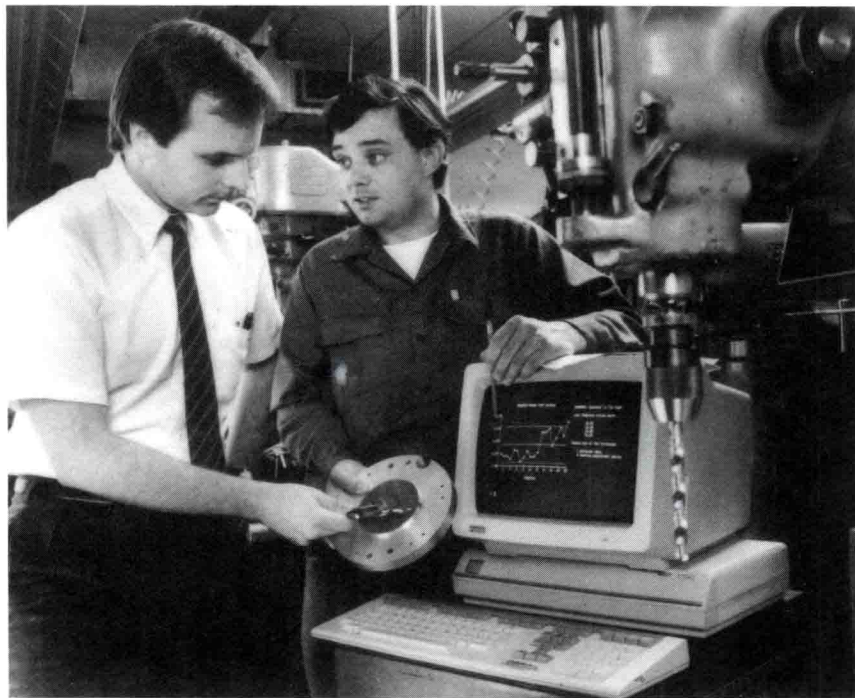
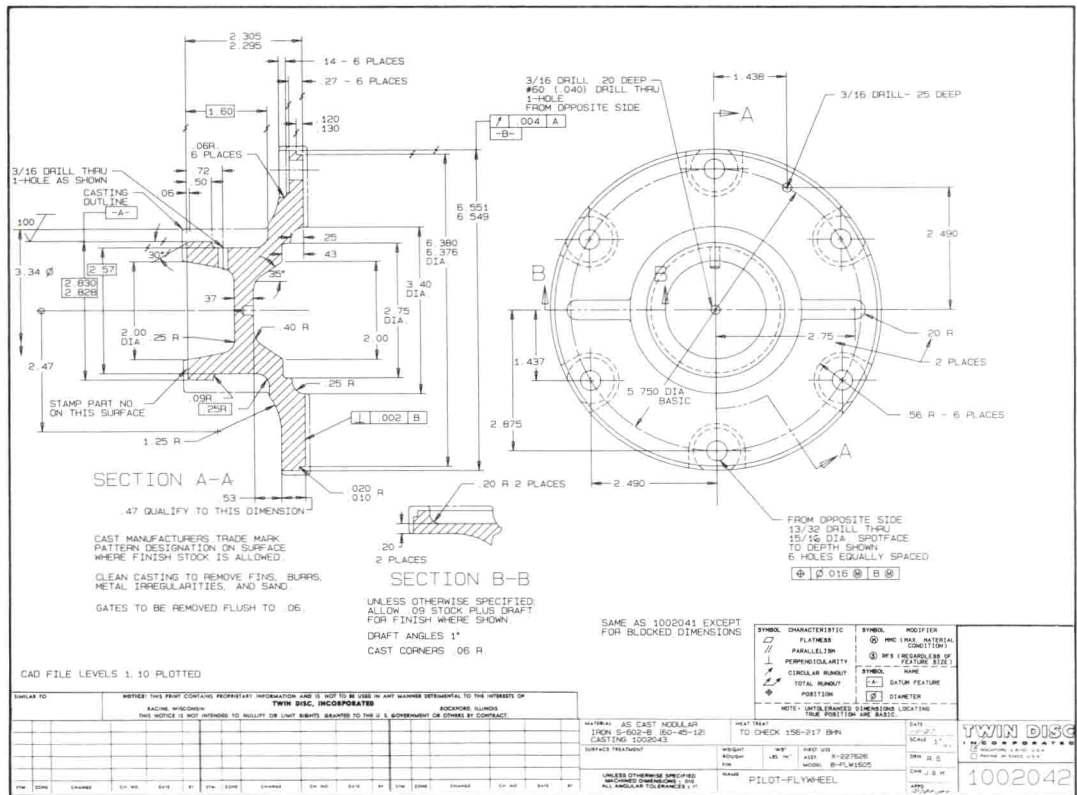
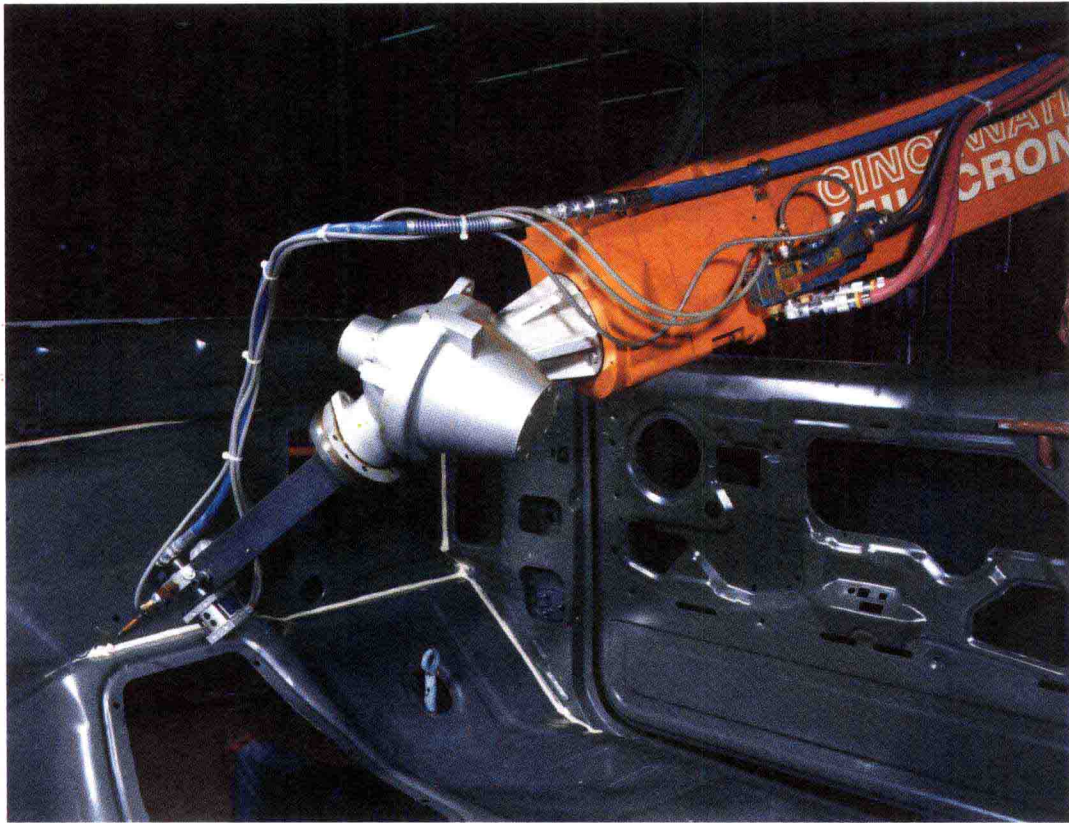
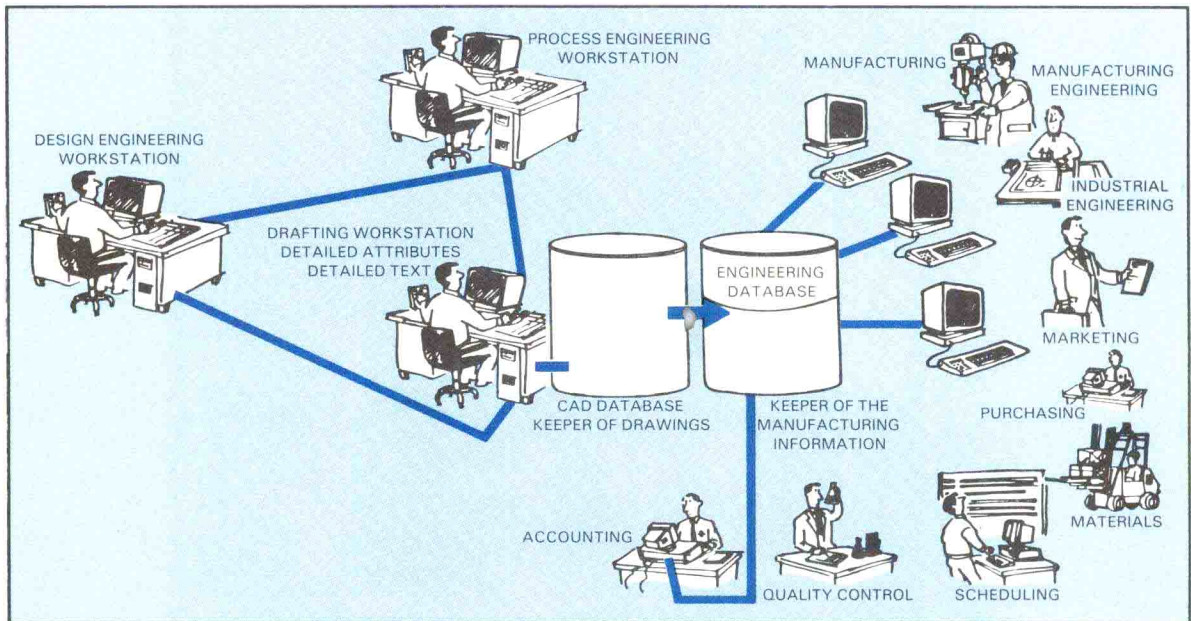


Fig. 1-4. Mechanical drafting involves making drawings that describe the shape and size of manufactured products. Here, a flywheel was machined. (Twin Disc, BNN Software Products)



A



B

Fig. 1-5. A — This robot which welds door panels is part of a computer-integrated manufacturing system. (Cincinnati Milacron) B — A CIM system improves quality and productivity because the same data can be used by many departments. (GMD, Inc.)

## 1-6 AutoSketch for Drafting and Design



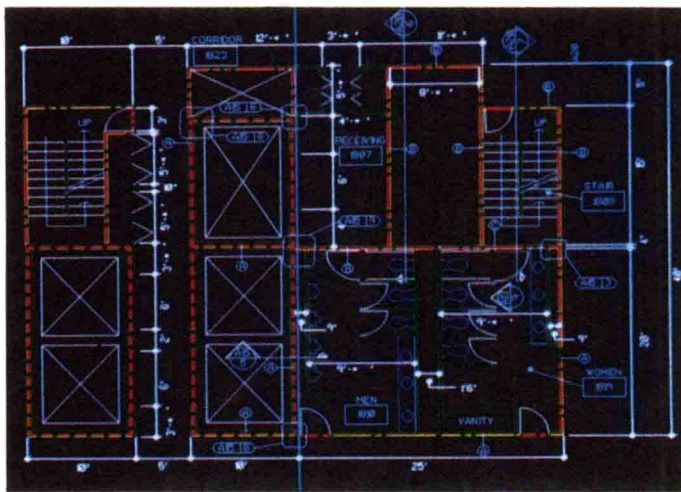
**Architectural drafting.** *Architectural drafting* involves preparing drawings that describe the structure and materials for residential and commercial buildings, Fig. 1-6. There are a number of drawings, or plans, that make up working architectural drawings.

- Plot plans describe the parcel of land, its perimeter, elevations, and the building location.
- Foundation plans describe the concrete, block, or other materials and members needed to support the structure.
- Floor plans show the division of space and location of walls, doors, and windows.
- Electrical plans explain the fixtures and wiring necessary to distribute electricity.
- Heating, ventilation, and air conditioning (HVAC) plans show how the building environment will be controlled.
- Plumbing plans trace the flow of water and waste.
- Elevation plans present the appearance of the building.
- Landscape plans show the layout of trees, shrubs, and other ground cover surrounding a building.

Architectural drawings contain many symbols that represent doors, windows, lights, sinks, and appliances. AutoSketch, and most CAD programs, allow you to store important shapes and symbols on disk. Then, rather than drawing each symbol, you simply insert them on the drawing from disk storage. Drawing, storing, and inserting parts (symbols) are covered in Chapter 15.

Another CAD feature useful in architectural and mechanical drafting is automatic dimensioning. The drafter simply points to the distance to dimension. The CAD program responds by drawing the dimension lines and adding the measurements. Dimensioning is discussed in Chapter 13.

**Electronics drafting.** *Electronics drafting* involves the design and layout of circuits, parts, and wiring for electrical and electronic products, Fig. 1-7. The initial layout is often done by inserting predrawn symbols that represent standard electronic parts. A drafter can manually add the lines that connect parts or have it done automatically by routing software.



A



B

Fig. 1-6. A—This floor plan shows the division of space and location of utilities. (Intergraph)  
B—An elevation view being drawn on a microcomputer CAD system. (IBM)

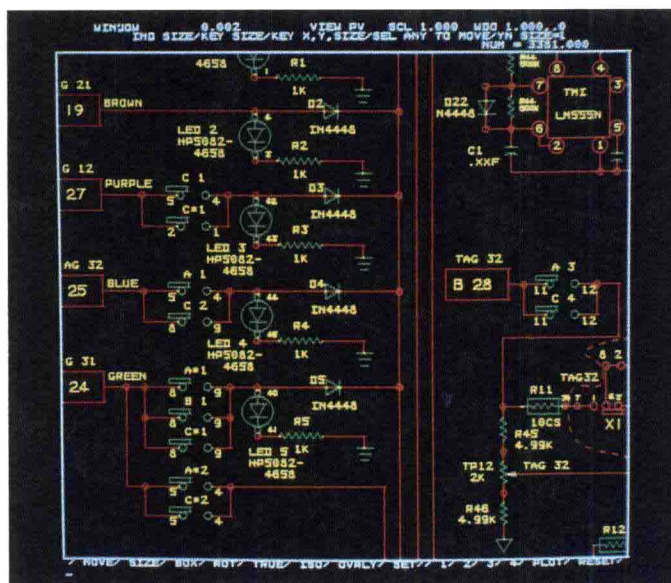


Fig. 1-7. Electronics drafting involves designing circuits for electrical and electronic products. (CADAM)

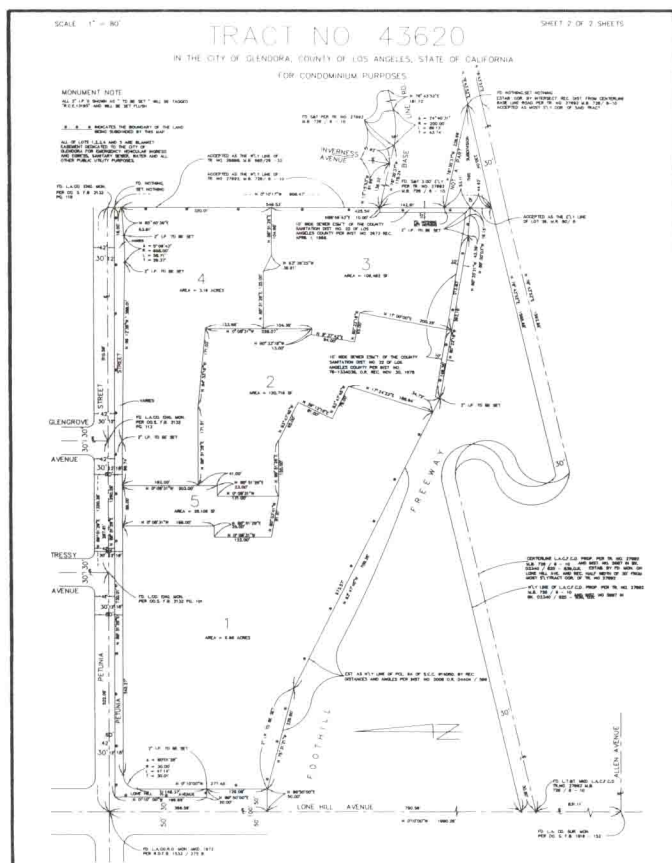


Fig. 1-8. This land survey is an example of civil drafting. (G. Bart Stryker)

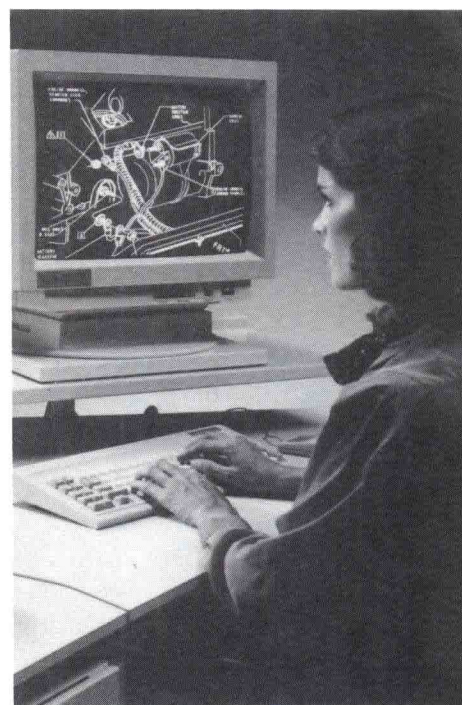


Fig. 1-9. This technical illustrator is labeling the mounting parts for a starter of a car motor. (Datagraphic Systems)



**Civil drafting.** *Civil drafting* is the process of making drawings that describe land terrain, road systems, and utility systems, Fig. 1-8. With CAD, diagrams can be drawn and modified easily.

### Technical Illustration

*Technical illustration* involves making two- or three-dimensional (pictorial) drawings for assembly or presentation, Fig. 1-9. A technical illustrator draws the part and may use shading or color to make it look realistic. The drawing could be an exploded view to show how parts fit together. Each part may be identified by name and number. An illustration for presentation usually shows the product assembled, and in full color.

### Graphic Design

Many advertising firms, publishing companies, and corporate printing departments have replaced pencils with computers for graphic design. The special effects computers create have become a trademark of modern graphic design, Fig. 1-10.

Publishing firms apply a CAD system in creating artwork for books and magazines. Much of the art in this book was drawn using a CAD system. In the past, artwork was slowly done by hand using technical pens. When corrections were needed, the artist carefully whited out and redrew them. Such modifications are quite time consuming. With a computer, changes are made quickly using editing commands. Artwork is then produced using a hardcopy device to insure smooth, consistent linework.

A benefit of graphics created on computer is that they can be brought directly into desktop publishing (DTP) programs. DTP programs combine existing text and graphics to create

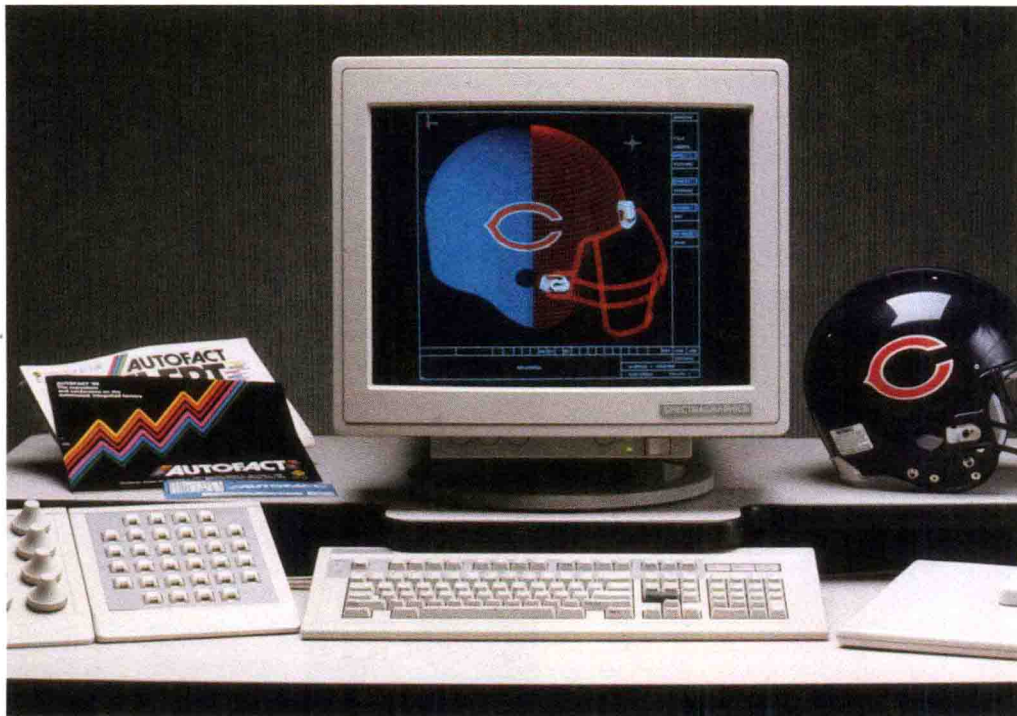


Fig. 1-10. Graphic designers have turned to computers. (Spectragraphics)

pages for brochures, advertisements, and books. The text can come from any word processor, spreadsheet, or database software. The graphics can come from paint programs, scanned photographs, or CAD programs such as AutoSketch.

## Business Graphics

Companies use CAD to create charts and graphs, Fig. 1-11, in addition to product drawings and illustrations. These might include diagrams of production flows and process sequences. Charts also present sales and marketing data clearly. Coloring different parts of the graph further explains the information.

## TOOLS OF CAD — HARDWARE AND SOFTWARE

Earlier in the chapter, you were introduced to some manual drafting tools. Most drafters find that a computer is simply a more efficient drawing tool. Your computer-aided drafting system is a combination of software and hardware. The software for the purpose of this text is AutoSketch. The hardware includes:

- **Computer.** The computer is the brains of your CAD system. It runs the AutoSketch software.
- **Data storage device.** A data storage device stores the CAD program and your drawings. AutoSketch works with a hard disk or removable disks, such as floppy disks and microdisks.
- **Display screen.** The display screen, or monitor, is your window to the drawing. It shows the drawing held in computer memory and also AutoSketch menus and commands.
- **Input devices.** Input devices allow you to enter commands and draw on screen. With AutoSketch, you will use a keyboard and a mouse or digitizer.

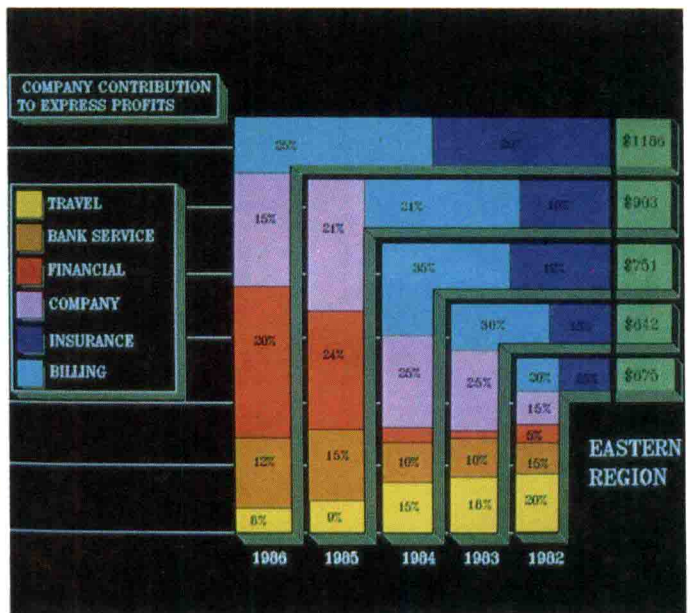
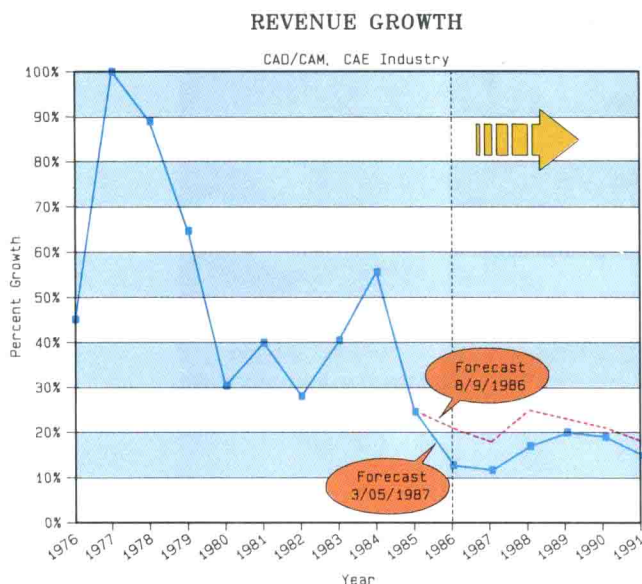


Fig. 1-11. Business graphics. Note how color can enhance the appearance of a graph. (Daratech, IBM)

## 1-10 AutoSketch for Drafting and Design