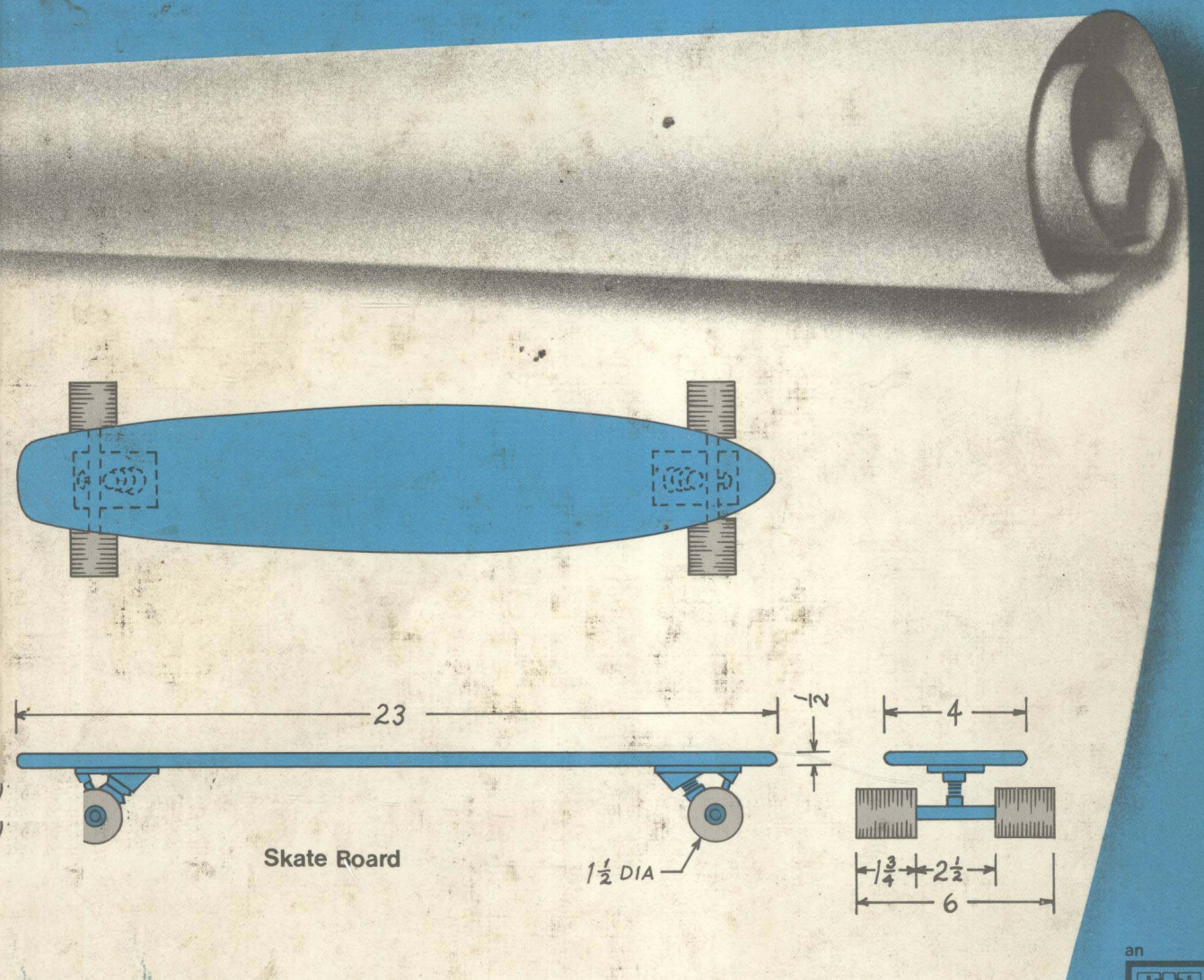
The Basic Book of

Drafting

Paul I. Wallach



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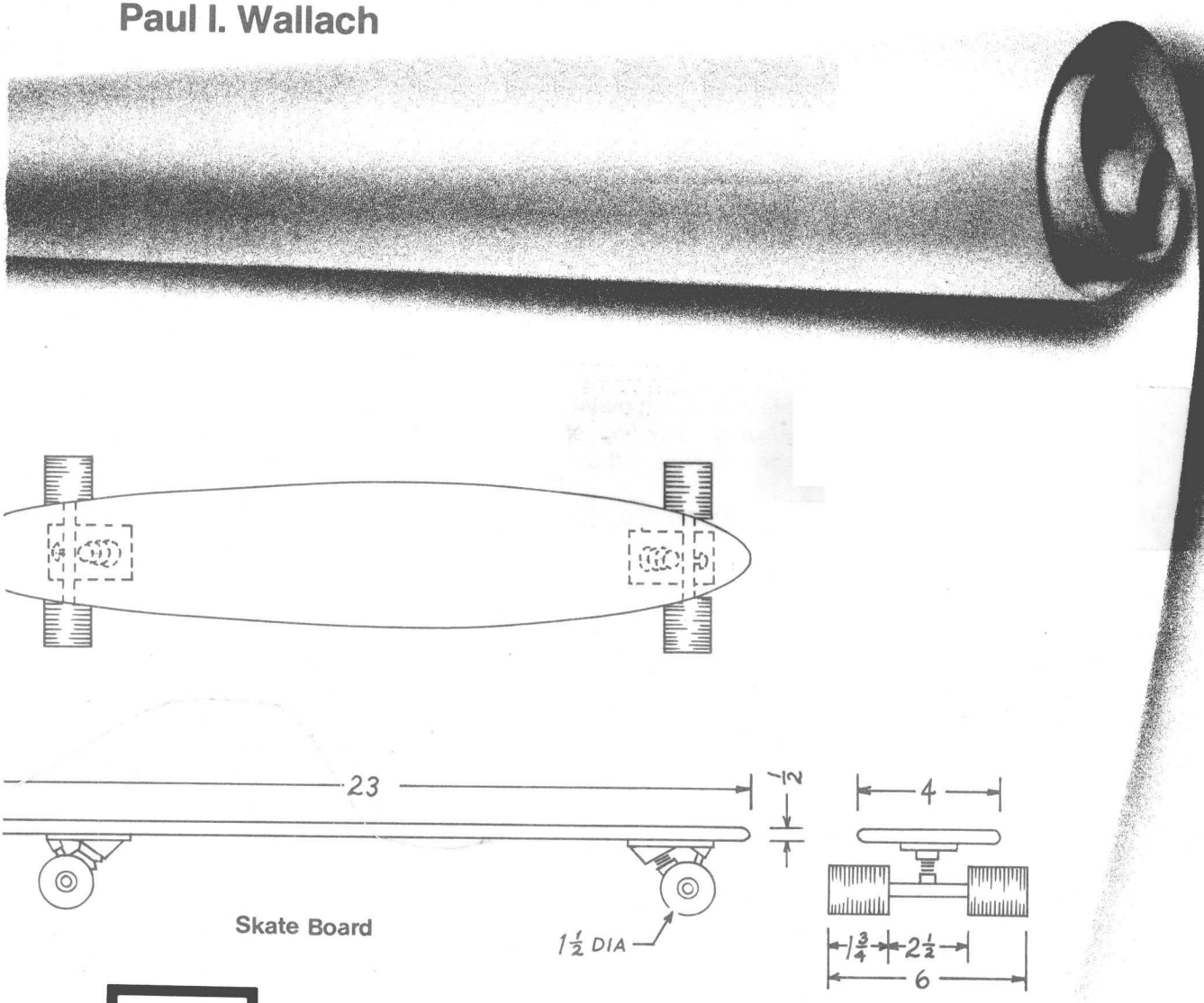

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PREFACE

THE BASIC BOOK OF DRAFTING is part of an integrated series of Industrial Arts textbooks designed to teach basic skills to beginning students. Its major objectives are career exploration, developing visual perception, knowledge of industry, and fundamental drafting abilities. The philosophy of THE BASIC BOOK OF DRAFTING is based on a recent, nationwide survey in which drafting teachers at all levels were asked to outline the courses they actually taught and let us know what types of instructional materials they actually needed. The result is a highly visual text with a controlled reading level that will help insure student success.

The author and the publisher wish to acknowledge and thank the following individuals, agencies, and corporations for their assistance and cooperation: Auto-Trol Corp., Pete Blair, Brodhead-Garrett Corp., Bruning Division of Addressograph-Multigraph, Cessna Aircraft Co., John Deere Co., Mike Giles, Modulux Division of U.S. Gypsum, NASA, Bill Rehlaender, Teledyne-Post, Vemco, and Laslo Virag, White Motors.

In line with a recent United States Bureau of Standards ruling, metre and litre are spelled meter and liter in this book.

CONTENTS

1 INTRODUCTION

Imagine you have been granted a fantastic wish. You may have your own private home in a space station, built just the way you want it. Would you like a special living area, space observation decks, special rooms, your own laboratory?

You can have the space station your own way if you can show the people who build it exactly what you want.

That is what drafting does. Drafting is a way of drawing ideas so they can be made into something. An idea such

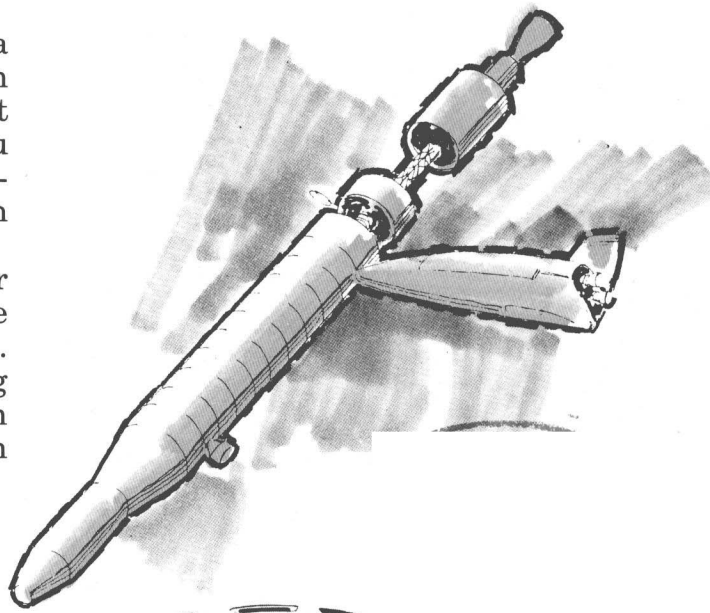


Figure I-1: Could this be your spaceship?

Figure I-2: Imagine the view of earth.

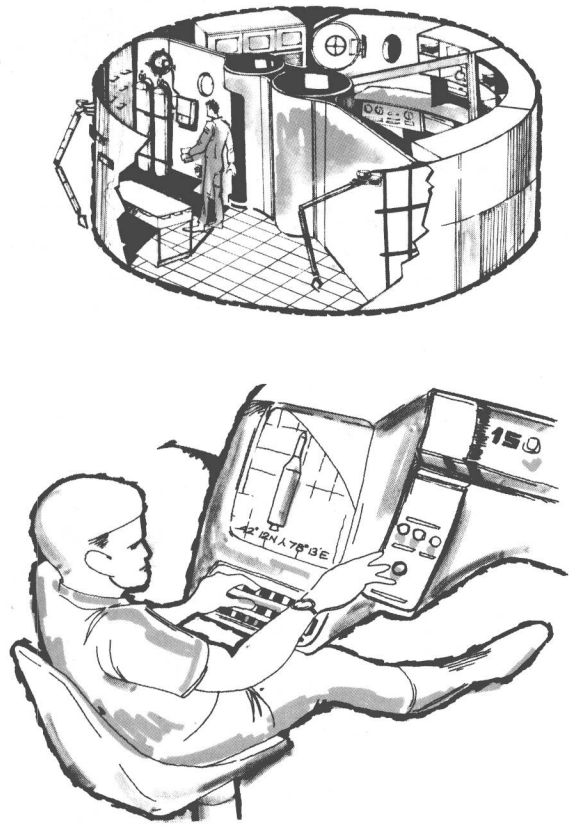


Figure I-3: Your space laboratory would need the most advanced computers available.

as your space station must be drawn in many ways. Thousands of drawings would be needed to show construction details. Hundreds of drawings will be needed to show how it will look—inside and outside.

Figure I-4 is an example of a drawing that a worker will use to build the shuttle. It is called a working drawing. It shows details workers need to build the parallel burn system. Figure I-5 is an example of a perspective drawing. It could be used for reports or public relations work.

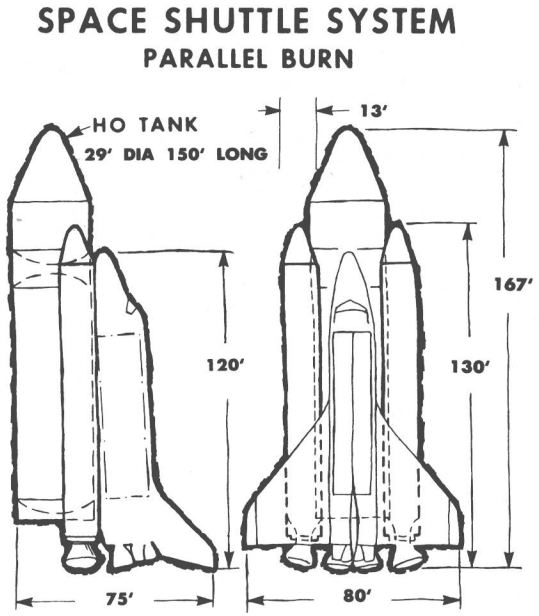


Figure I-4: A working drawing of the space shuttle.

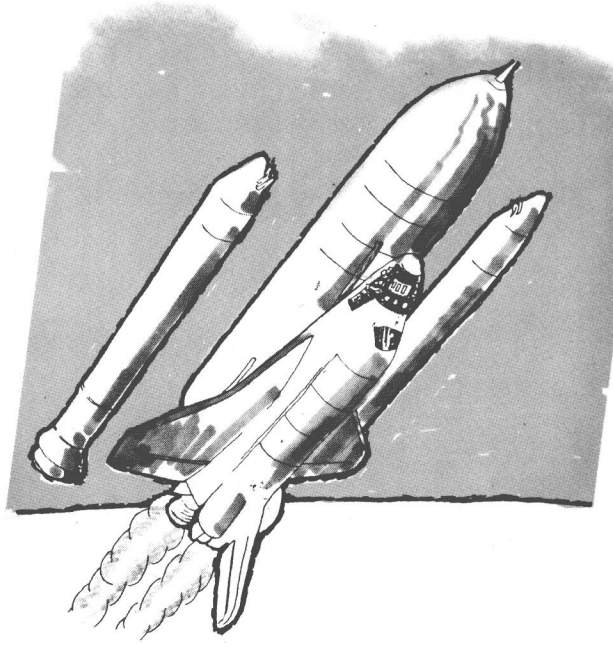


Figure I-5: A perspective drawing of the space shuttle.

DRAFTING-AN OVERVIEW

Unit 1

All industries use drafters in their work. Space engineers, car manufacturers, house builders, and toy makers would be helpless without mechanical drawings. Without drawings, machines like airplanes (figure 1-1), trucks (figure 1-2), and space shuttles (figure 1-3) couldn't be built.

Drafting is basic to planning and making everything from a simple door stop (figure 1-4) to a Viking lander (figure 1-5). Besides showing what the

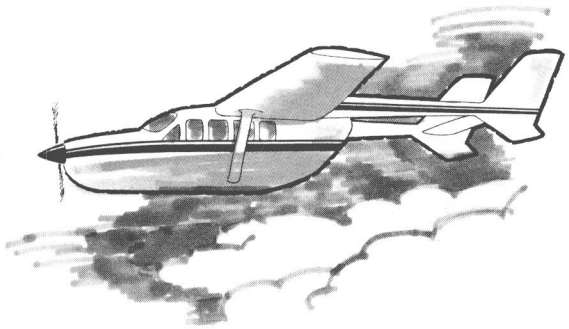


Figure 1-1: Without working drawings many machines couldn't be built.

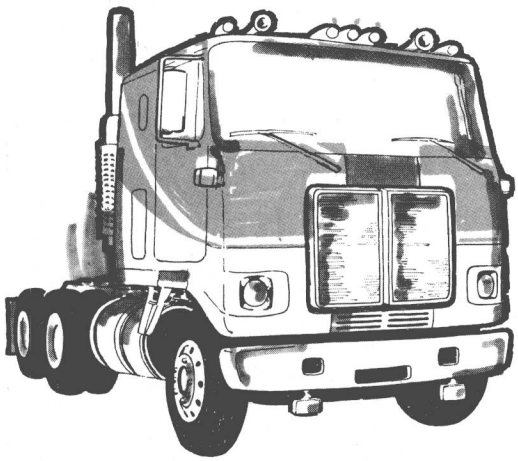


Figure 1-2: Trucks start as drawings on paper.

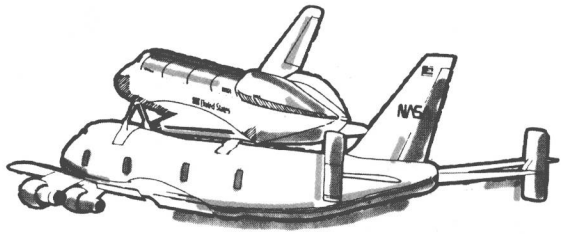


Figure 1-3: To build something complex, like a space shuttle, takes thousands of drawings.

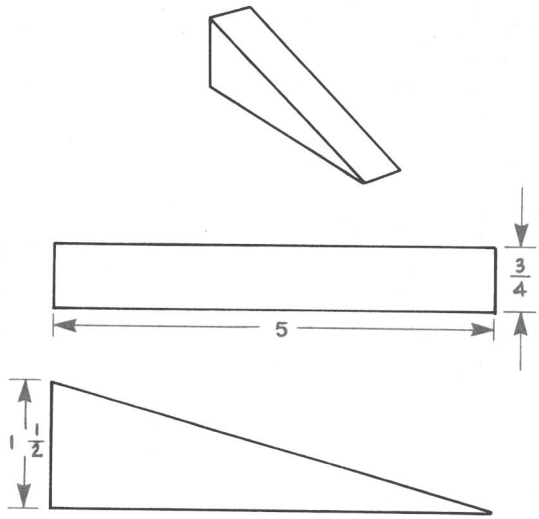


Figure 1-4: Even the simplest object, the door stop, begins as a drawing.

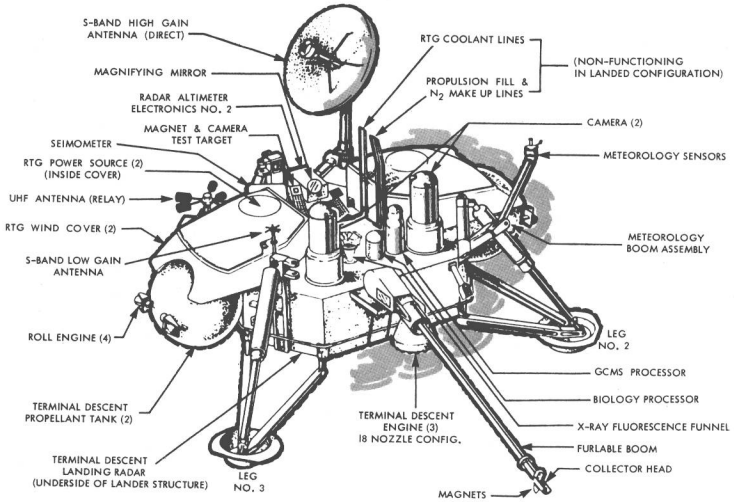


Figure 1-5: A drawing of the Viking Lander.

Figure 1-6: The drafter is the key to a good drawing.

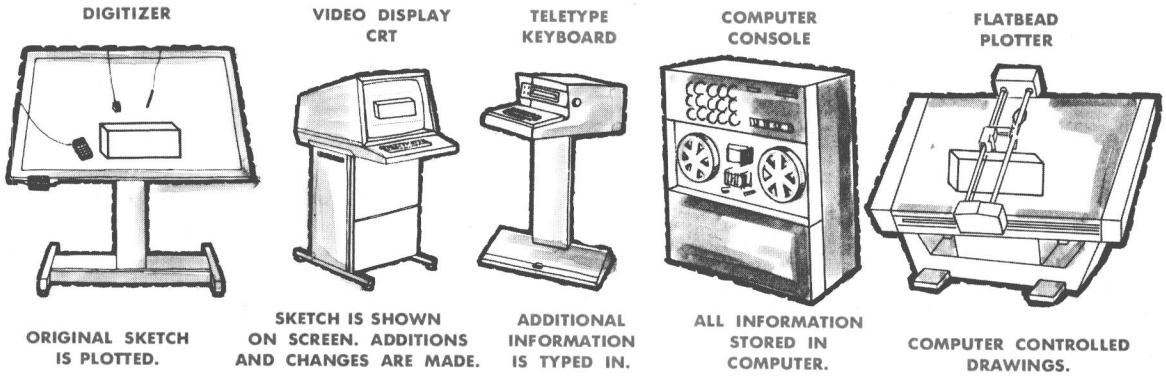


Figure 1-7: Modern technology has built computer drafting systems. A drafter had to draw the plans.

finished product will look like, mechanical drawings have notes on how to build the product. Skilled people, using the drawings and notes, can turn ideas into products.

Drafters are only one source of mechanical drawing (figure 1-6). The drawing skill of people is important, but computers also make mechanical drawings.

A computer system can store all the information about a drawing, display the drawing on a screen and then make the drawing when needed. Computer drawings can be changed immediately. Figure 1-7 is a typical computer drafting system. Such a system produces computer drawings like the one in figure 1-8.

Computers can also show different views of the same drawing (figure 1-9). A computer can design a tool, create the drawings to build it, and then run the machinery to make the tool.

Microfilm is another aid to the drafter. It is a small strip of film usually 35

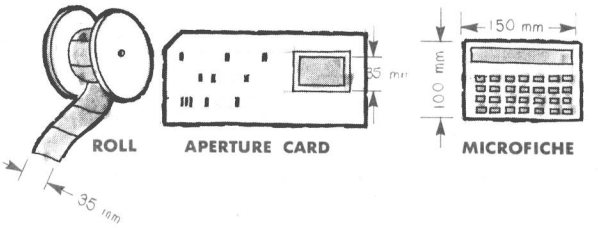


Figure 1-10: Microfilm comes in many shapes. But all of them save space.

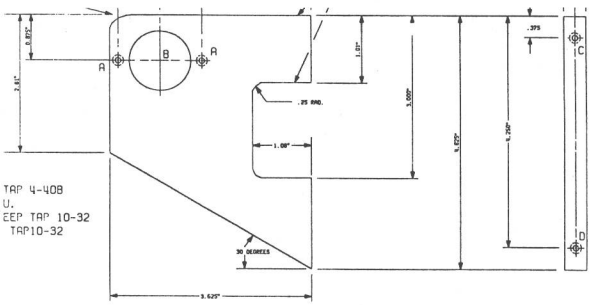


Figure 1-8: This drawing was made by a computer.

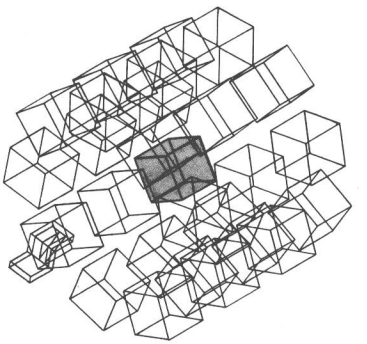


Figure 1-9: Computers can redraw an object in any position.

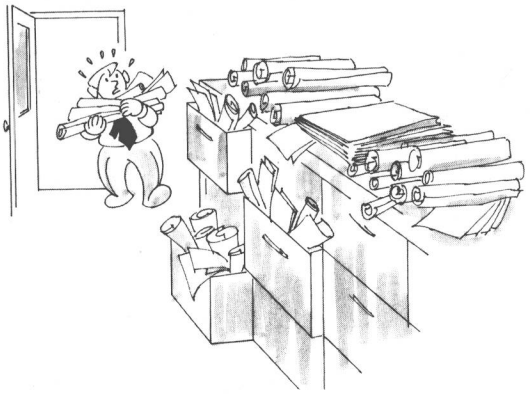


Figure 1-11: Modern technology needs so many drawings that storage is difficult.

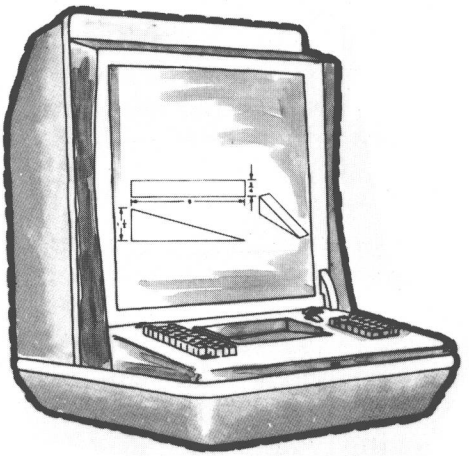


Figure 1-12: Microfilm and microfilm readers solve some drafting storage problems.

millimeters wide (figure 1-10). Other microfilm widths are 16 mm and 105 mm. Because some projects take hundreds and even thousands of drawings, storage of the mechanical drawings is a problem (figure 1-11).

On microfilm a drawing is reduced to the size of your fingernail. When needed, a full-sized copy of the drawing can be made. The advantage of microfilm is that it can be stored in a small space and kept ready to read or to print at any time (figure 1-12).

Videotape can also be used to store drawings. The drawing can then be shown on a television screen with a voice giving descriptions and instructions. If needed, a print of the drawing can be made from the videotape.

SELF CHECK

1. List all of the industries you can think of that use drafters.
2. List three advantages of computer drawings.
3. Why is microfilm important to the drafter?
4. List three ways drawings can be stored.

DRAFTING LEVELS

Suppose you are the president of Fly 'Em High Space Ship Corporation. Your company is making the first space ship to go to Pluto. Would you say to your thousands of employees, "OK, you all know what a spaceship is. Get to work."? Of course you wouldn't. Different people have special jobs only they can do. Each must be given their own part of the space ship project to do (figure 2-1).

Drafters may also have special jobs. The tracer is a person who traces or copies drawings another drafter has made. Many highly skilled drafters began as tracers. Being a tracer is an entry level job. That means the tracer doesn't need as many skills as some of the other drafters. Detailers make simple changes on existing drawings. A senior detailer, who has more knowledge and experience than a junior detailer, may make a complete drawing from a design or from verbal directions.

Checkers look for errors in other people's drawings. The professional checker must have lots of experience and know a great deal about drafting.

A designer is a problem solver who uses drafting skills, creativity, and technical information to help complete a design. The designer may work with engineers and scientists to create the right design.

Besides the tracer, detailer, checker, and designer, there are other specialized drafters. Each specialty depends on different skills and responsibilities, but each makes the finished project possible.

Specialty drafting skills are used in many different industries. The drafter must learn the special skills for the industry they want to work in.

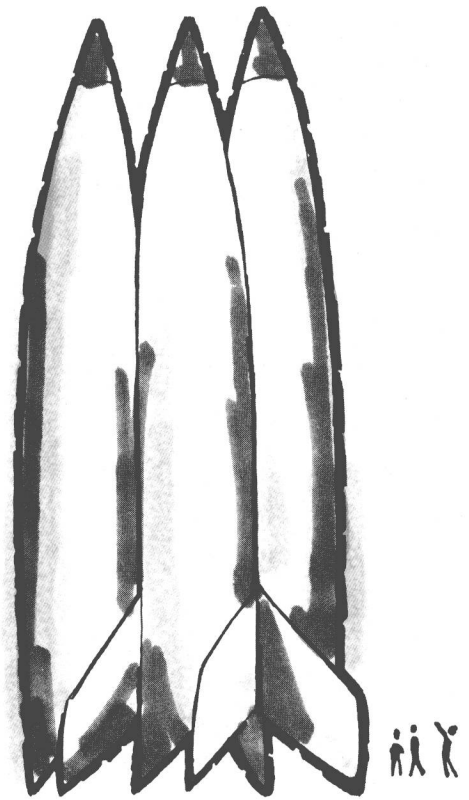


Figure 2-1: Spaceships challenge the drafter's ability.

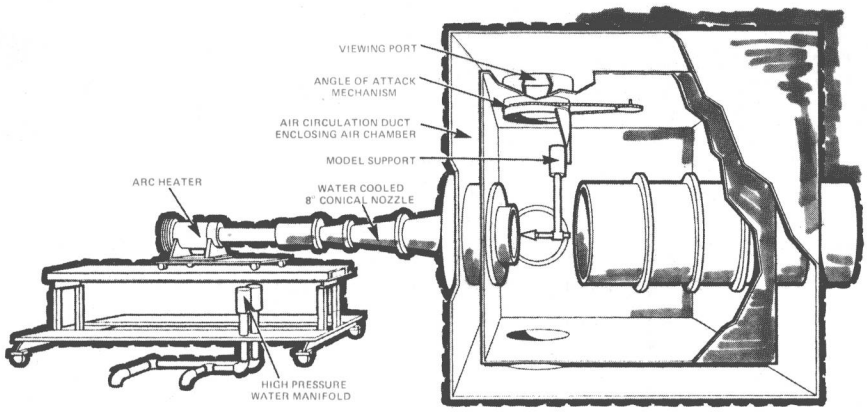


Figure 2-2: Technical illustrations may be a simple cartoon or an atomic energy complex.

Commercial artists usually work in advertising. They must know about art materials and printing. Commercial artists use oils or acrylics, charcoal, water colors, and India ink.

Technical illustrators usually draw in ink. Ink drawings reproduce well under all conditions. A technical illustrator may draw everything from technical drawings to cartoons.

Tool designers need to know machines and engineering, manufacturing methods, and mathematics as well as sketching and drawing.

An architect designs buildings by considering how people will use them and how they will look. Like all drafters, they must know the basic drawing skills. But they must also know building methods, materials, and artistic design.

SELF CHECK

1. What does a tracer do?
2. What is a person who looks for drafting errors called?
3. What does a designer do?
4. List three "specialty drafting" areas.

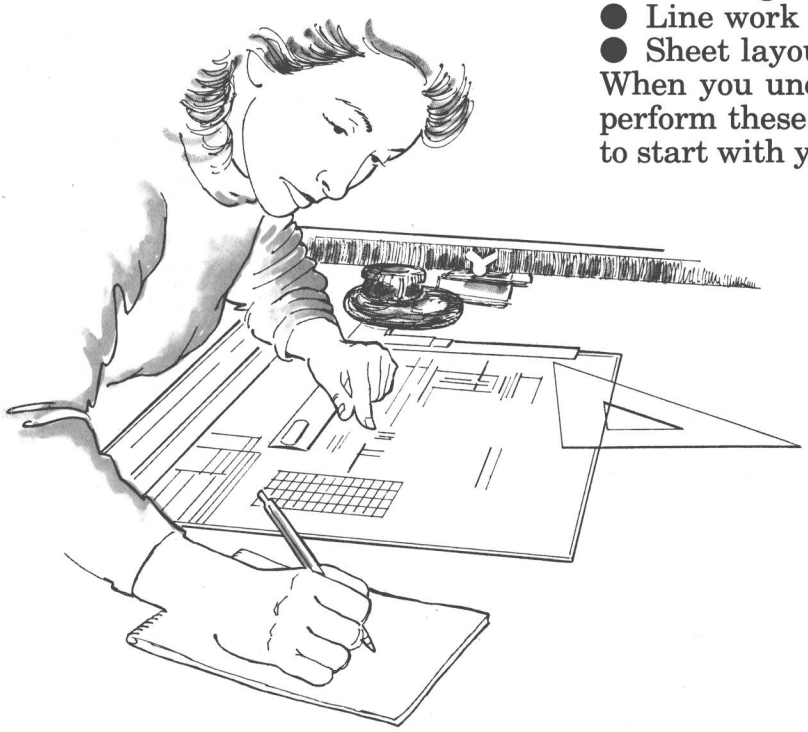
STARTING TO DRAW

2

Before you start to draw, there are several areas that you must know about and certain skills that you should have. These areas are:

- Lettering
- Drawing equipment and supplies
- Line work
- Sheet layout

When you understand and are able to perform these skills, you will be ready to start with your mechanical drafting.



LETTERING

Figure 3-1: Vertical single stroke gothic letters and numbers.

Figure 3-2: Microfont letters and numbers.

Figure 3-3: Slanted single stroke gothic letters and numbers.

Good lettering is as important as good drafting. Clear letters on a drawing help others to read your drawings. Most employers will not hire you if your lettering is poor.

Two types of lettering are used on most mechanical drawings. These two methods of lettering are:

- Single stroke gothic (figure 3-1)
- Microfont (figure 3-2)

Single stroke gothic letters have been used for many years. Microfont lettering was invented for drawings that are recorded on microfilm, a fairly new process. When microfilmed and then reprinted, single stroke gothic letters and numbers lack clarity.

Single stroke gothic letters can be printed straight up and down (vertically) as in figure 3-1. Single stroke gothic can also be slanted as in figure 3-3. Microfont lettering is always straight up and down. Any method that correctly forms single stroke gothic or microfont letters and numbers will be satisfactory.

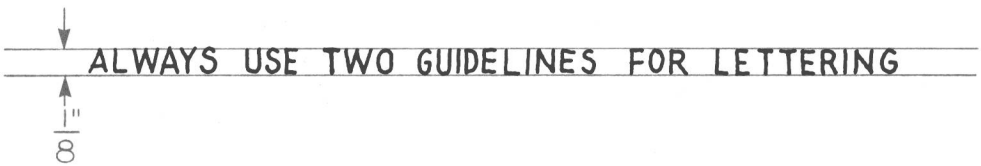


Figure 3-4: Lettering is done between two sharp, thin, light lines called guide lines.

Guide lines (figure 3-4) help keep letters and numbers the same height. Before you start to letter, you must draw guide lines with a sharp 4H or 6H pencil lead.

Guide lines are set 1/8″ apart because most lettering is 1/8″ high, but fractions need more room. Fractions are usually 3/16″ high (1/8″ equals 2/16″). Each number should be slightly smaller than 1/8″. The fraction bar is straight and the numbers do not touch the bar (figure 3-5).

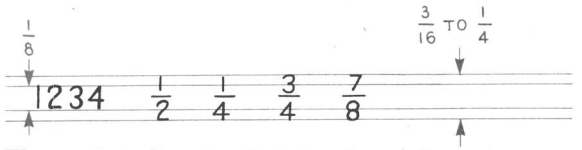


Figure 3-5: Fraction heights for 1/8″ numbers are 3/16″ to 1/4″ high.

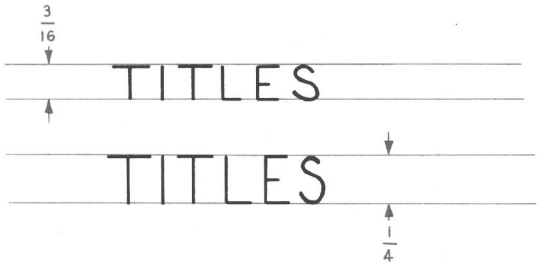


Figure 3-6: Titles are larger than regular lettering. Large drawings may also use larger lettering.

Figure 3-7: Correct and incorrect lettering.

Bigger letters are sometimes used for titles or on very large drawings. Guidelines for such lettering are usually drawn 3/16″ or 1/4″ apart (figure 3-6).

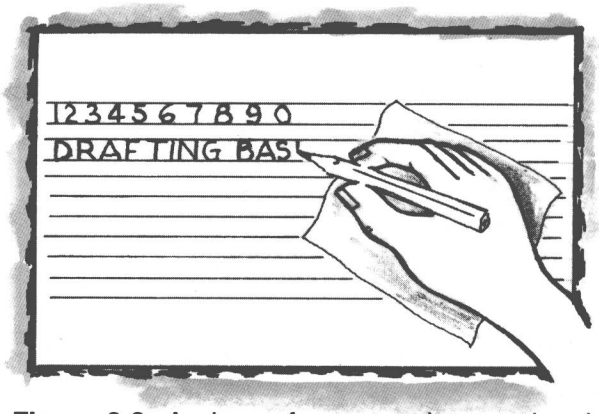


Figure 3-8: A piece of paper under your hand will help prevent smudging.

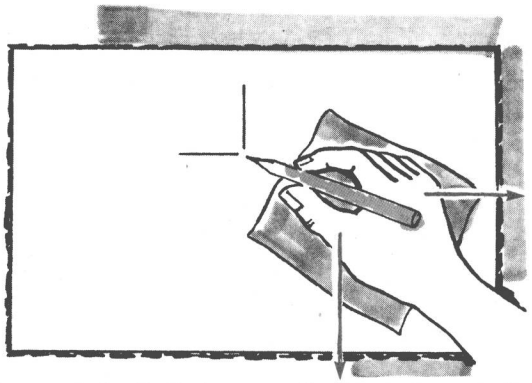


Figure 3-9: Pull the pencil. Do not push it to draw.

BASIC DRAFTING CORRECT

BASIC DRAFTING TOO CLOSE

BASIC DRAFTING TOO FAR

BASIC DRAFTING HEIGHTS DIFFERENT

Only practice will give you the "feel" for making letters look right. Figure 3-7 shows correct and poor examples of lettering styles. Figures 3-8 through 3-13 show examples of good practice rules and some practice strokes.

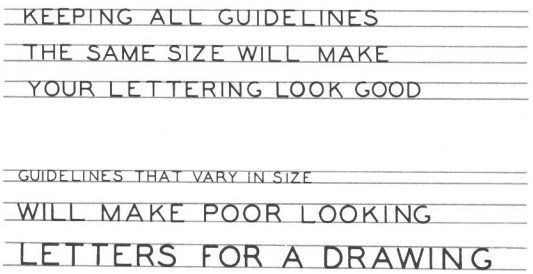


Figure 3-10: Keep all guide lines the same width. Measure the guidelines in both samples.

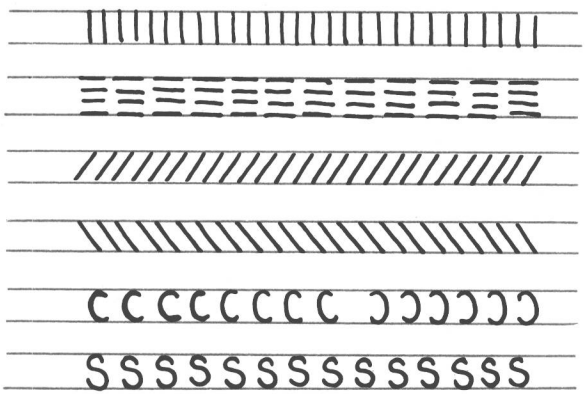


Figure 3-11: Practice exercise for vertical lettering.

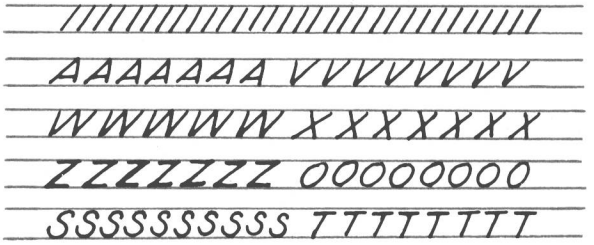


Figure 3-12: Practice exercise for slanted lettering.

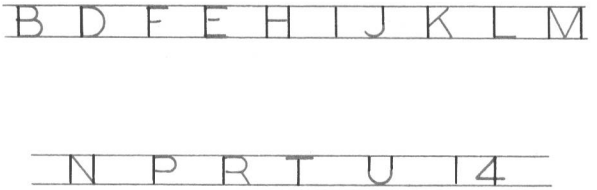


Figure 3-13: Note how the vertical (colored) strokes are drawn first.

SELF CHECK

1. What are the two lettering styles used on most mechanical drawings?
2. Which lettering style is used on drawings that will be microfilmed?
3. How high should most letters be?
4. How high should fractions be?