The CAD Interface

Unit: CAD and CADD

Problem Area: Introduce CAD/CADD

Lesson: The CAD Interface

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Describe CAD, CADD, and typical CAD applications.**
2. **Explain CAD interfaces.**

Resources.

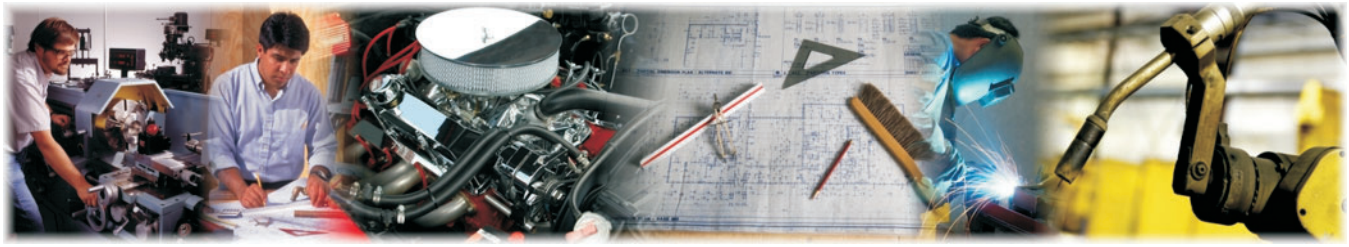
The following resources may be useful in teaching this lesson:

E-unit(s) corresponding to this lesson plan. CAERT, Inc. http://www.mycaert.com.

"AutoCAD and Its Applications—Basics 2017," *Goodheart-Willcox*. Accessed May 9, 2018. http://www.g-wlearning.com/cad/7352/index.htm.

"Learn Basic Auto CAD," *LearnBasicAutoCAD.blogspot.com.* Accessed May 9, 2018. http://learnbasicautocad.blogspot.com/2011/05/autocad-interface.html.

Shumaker, Terence M., David A. Madsen, and David P. Madsen. *AutoCAD and Its Applications Basics 2018*, 25th ed. Goodheart-Willcox, 2018.



Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials
- ✓ SchoolVue or comparable software that broadcasts the teacher computer to student computers

Key Terms. The following terms are presented in this lesson (shown in bold italics):

- 2D drawing
- 3D model
- application menu
- CAD interface
- command line
- computer-aided design and drafting (CADD)
- computer-aided drafting (CAD)
- context-sensitive
- default value
- dialog box
- docked toolbar
- escape key (Esc)
- floating toolbar
- graphical user interface (GUI)
- interface
- keyboard shortcut
- palette
- quick access toolbars
- ribbon
- ribbon panel
- shortcut menu
- space bar
- standards
- Start tab
- status bar
- toolbar
- ToolTip
- workspace

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

> *Computers revolutionized the way we live and work. In the drafting industry, computer-aided design and drafting (CADD), utilizes programs for designing and drafting applications. What type of computer is used in a CAD environment? What type of software is available? CAD designs are both two-dimensional (2D) and three-dimensional (3D). Ask the class to develop a definition of the difference between 2D and 3D designs. Then, go to the CQEFlash YouTube video, "Computer Aided Design," at https://www.youtube.com/watch?v=Fyd8Id2s76A to see a video that encapsulates the entirety of CAD applications.*

CONTENT SUMMARY AND TEACHING STRATEGIES

Objective 1: Describe CAD, CADD, and typical CAD applications.

Anticipated Problem: What is CAD? What is CADD? How is CAD software used? What are typical industrial and commercial applications?

I. There are many uses for CAD software. Every year, more and more industries utilize CAD capabilities in the construction of everything from cars to dresses. Some of these uses and basic CAD definitions will be approached in this lesson.

A. CAD: ***Computer-aided drafting (CAD)*** is software used to create precision drawings, technical illustrations, or models according to specific industry or company standards. CAD can be used to create 2D drawings, 2D and 3D surfaces, or 3D models. CAD software is used to increase productivity, to improve communications through documentation, and to create a database for manufacturing. CAD utilizes international, national, and industry-specific standards. ***Standards*** are the guidelines that specify drawing requirements, techniques, operating procedures, record-keeping methods, and appearance. CAD output is often in the form of electronic files. These files are used for:

1. Printing hard copies
2. Storing work in the cloud for collaborative purposes
3. Storing drawings on a hard drive
4. Sending files directly to CNC (computerized) machinery

B. CADD: ***Computer-aided design and drafting (CADD)*** is CAD with additional drafting and design features. With CADD, you can design and visualize 2D

drawings and/or 3D models. A ***2D drawing*** (2D) is an illustration that occupies two dimensions and resides only on the x- and y-axes. A ***3D model*** (3D) is a drawing that occupies three dimensions, the x-, y-, and z-axes. For example, you use CADD to design an I-beam for a bridge system. This I-beam must support the load of the entire structure. If not calculated correctly, the bridge would collapse. The creation of this design involves more than just shapes. The output of CADD must convey 3D information to correctly identify:

1. Materials
2. Processes
3. Dimensions
4. Tolerances

C. MANUFACTURING: There are many CADD applications in the manufacturing sector.

1. *Aerospace:* Aerospace is a high-tech industry that manufactures space vehicles, satellites, aircraft, missiles, and equipment components. The price tag on any single aerospace product can be several million dollars, and CAD software plays an integral role in making sure things are built to spec. Before the product is constructed, every detail is thoroughly planned using CAD software.
2. *Architecture:* Architectural designs that are created for large, expensive buildings (or small, cost-savings ones) require tedious planning. CAD is used to design 2D and 3D floor plans and schematics for, houses, office buildings, and industrial structures. Aside from the actual architecture and layout of a structure, CAD is used to determine proper equipment, building, and material specifications prior to construction.
3. *Automotive:* Automotive companies use CAD software in every aspect of vehicle design. It's used to create prototypes of new body styles and to design auto components such as tires, engines, circuitry boards, upholstery, and more.
4. *Cartography:* Cartography is the creation of maps. Throughout history, most maps were drafted by hand. Modern cartographers use CAD to chart climates, roadways, and topographic maps. Autodesk has a Maps 3D CAD system that can create realistic geographic and topographic maps.
5. *Civil Engineering:* Civil engineers are urban planners. They use CADD software to design municipal infrastructure elements, including bridges, parks, industrial units, office complexes, and more.
6. *Fashion Design:* Fashion designers often sketched one-of-a-kind creations by hand. Now, they can not only use CAD software in the latter part of the design process to provide more detail for manufacturers, they can also use integrated touchscreen pads to draw. Clothing manufacturers use CAD software to determine the most efficient use of materials and to adjust the scale of patterns to different sizes. Using virtual models, the software can even be used to show how clothing will fit and move. Designers are then able to make any necessary modifications to the design prior to production.

7. *Interior Design:* Interior designers bring their visions to life through detailed 2D and 3D CADD designs. This software allows designers to show clients how a room will look, right down to the paint color.
8. *Landscape Architecture:* Landscape architects use CAD software to conceptualize stunning outdoor creations and to determine the best placement of various landscaping components, such as trees, fences, gardens, patios, etc.

Teaching Strategy: *Lead a discussion of the differences between CAD and CADD. Provide examples of CADD options not found in basic CAD. Show videos of modern day CADD operations and how CADD impacts the world of design. Use VM–A and VM–B to review a 2D drawing and a 3D model application. Use VM–C to review CADD applications. Show and demonstrate the CAD workstation using SchoolVue or a comparable software. Have the students research the industries or products that use CAD software in manufacturing. [NOTE: This lesson was prepared assuming the use of the Autodesk product AutoCAD.]*

Objective 2: Explain CAD interfaces.

Anticipated Problem: How do you begin to interface with AutoCAD? What is an interface? What are examples of CAD interfaces?

II. An ***interface*** is any device used to input data, such as the keyboard and mouse, and the devices used to receive computer inputs, such as the monitor. A ***CAD interface*** is a windows-style tool that includes an application menu bar, ribbon, dialog boxes, AutoCAD toolbars, and other CAD-specific items. This lesson will show AutoCAD 2018 interface features and basic CAD principles. These basic principles will apply to all versions.

A. OPEN PROGRAM: First, the user opens AutoCAD by one of the following methods:
   1. Double-clicking the CAD program icon on desktop.
   2. Right-clicking the CAD program icon on desktop and then selecting **Open**.
   3. Clicking on the Windows **Start** button and then clicking on the CAD program.

B. START TAB: The ***Start tab*** is an element of the AutoCAD tab system that displays immediately upon launching the program. [NOTE: In the 2018 version, this tab is not automatically started. The user has to select it as an auto feature.] This tab provides easy access to drawing template files, recently opened files, and online learning options.
   1. **Start Drawing** opens a blank illustration or diagram.
   2. **Recent Documents** shows nine recently opened drawings or sheets. In newer versions, the top right-hand corner of each file image has a thumbtack icon. If clicked, the file will be “pinned” to always appear in recent documents.
   3. **Notifications** shows any product updates or tips.
   4. **Connect** provides instant access to online services.

C. GUI: The ***graphical user interface (GUI)*** is an onscreen feature that allows the user to interact with the software. This is a drafting and annotation workspace that activates when a user begins a new drawing. It displays interface features above and below a large drawing window (also called the graphics window), and it contains the commands and options used most often for 2D drawing. A ***workspace*** is a preset work environment containing specific interface tools. An existing workspace display can be converted to a different workspace, such as 3D Basics, or 3D Modeling. The use of CAD controls is similar to using controls in other windows-based program.

D. SHORTCUTS: A ***shortcut menu*** (also known as a cursor menu, right-click menu, or pop-up menu) is a general or context-sensitive menu available by right-clicking on interface items or objects. Since the menus are ***context-sensitive*** (tied to a specific, active command or option), they pop up for specific functions. For example:

   1. Left-clicking the mouse picks an item on the screen.
   2. Right-clicking the mouse activates shortcut menus for that selected item.

E. SPACE BAR: The ***space bar*** (the long key on a keyboard) can be substituted for the Enter Key or used to redeploy the previous command.

F. TOOLBAR: A ***toolbar*** is an interface that contains buttons that start commands. A toolbar can be floating or docked, and it can be hidden or displayed. A ***floating toolbar*** is an interface that contains tool buttons (in a drop-down list) that the user can display at any location in the graphics window. It can be dragged to a new location, resized, or docked. A ***docked toolbar*** is an interface that contains tool buttons or drop-down lists that are locked to a specific location in the graphics window. [NOTE: In many versions, the toolbar must be locked in order to use the space bar as an enter key.]

G. ESCAPE: The ***escape key [Esc]*** allows the user to break out of a command, option, or dialog box.

H. APPLICATION MENU: The ***application menu*** is a list of commands relating to the drawing as a whole, such as creating new drawings, opening drawing files, printing, etc. Below is a list of menu options usually found.

   1. **New**
   2. **Open**
   3. **Save**
   4. **SaveAs**
   5. **Import**
   6. **Export**
   7. **Publish**
   8. **Print**
   9. **Drawing Utilities**
   10. **Close**

I. QUICK ACCESS: ***Quick access toolbars*** are interfaces that contain tool buttons representing a CAD command or option. They are the quickest, most effective ways to manage certain drawing settings. Default tool buttons include **New**, **Open**, **Save**, **SaveAs**, **Plot**, **Undo**, and **Redo**.

J. RIBBON: A ***ribbon*** is a series of tabs organized into panels that contain many of the tools and controls available in toolbars. A ***ribbon panel*** is a collection of panes divided into groups of commands. It provides a convenient location from which to select commands and options that traditionally require access by extensive typing. The ribbon docks horizontally below the **CAD** title bar by default. It contains the base menus for all functions. The tabs include **Home**, **Insert**, **Annotate**, **Parametric**, **View**, **Manage**, **Output**, **Add-ins**, **A360**, **Express Tools** (2018 version), **Featured Apps** (2018 version), and the minimize/maximize button.

K. PALETTE: A ***palette*** (**Tool palettes** in AutoCAD) is a special window containing tool buttons and features for specific graphics or commands. They have controls for many CAD functions, such as list boxes, scroll bars, line weights, arrow styles, modeling functions, etc. Palettes can remain open while other commands are active. A drafter can create their own **Tool palette** for use of commonly used commands and graphic controls.

L. STATUS BAR: The ***status bar*** controls a variety of drawing aids and commands, and it is often the easiest way to manage certain drawing settings. The status bar appears along the lower right edge of the CAD window, below the command line. The status bar includes:

1. **Model** or **Paper** button
2. Grid/Snap
3. Ortho
4. Polar Tracking
5. Isometric Planes
6. Object Snap Tracking
7. Object Snap Tools
8. Annotative Tools
9. Scale
10. Workspace Switching

M. DIALOG BOX: A ***dialog box*** is a windows-style interface that contains various settings and information. Many dialog boxes are available during a drawing session, including those used to create, save, and open files. An AutoCAD interface opens with a startup dialog box that is used to create or setup the first drawing file (from scratch, using a setup wizard or a template file). Dialog boxes contain many of the same features found in other interface items, such as icons, text, buttons, and fly-outs. [NOTE: A ***default value*** is a setting that AutoCAD maintains until the user changes that setting. Default values are inside the chevrons at the end of each question AutoCAD asks the user when a command is executed.]

N. COMMAND: The ***command line*** is a palette that can float, be docked, or be resized, and receive typed commands. The command line is located at the bottom of the graphic user interface and above the status bar. The user can type any command in the open command box, otherwise known as the command prompt.

O. SHORTCUT: A ***keyboard shortcut*** is a command alias (a code name) for a complete keyboard entry; usually a one-, two-, or three-key shortcut that issues a command or selects an option. Keyboard shortcuts allow the user to perform CAD functions quickly. Many keys on the keyboard are known as shortcut keys. Some examples include:

1. Pressing the **L** key = creates straight line segments
2. Pressing the **C** key = creates a circle
3. Pressing the **E** key = erase
4. Pressing the **PL** keys = a **PLINE** creates a 2D polyline (on the ribbon, displayed as **Polyline**)

P. TOOLTIP: A ***ToolTip*** is a small context-sensitive menu that pops-up when the user hovers over an icon.

Q. SAVING WORK: Work should be saved every 10 to 15 minutes. Some drawings and 3D models can get very large, which can cause the system to crash when too many files are open on the desktop. Frequent or automatic file saving can keep work from being lost. A user can choose the autosave feature by right-clicking in an empty drawing file. In the pop-up menu, the user would choose **Options**. In the **Open and Save** tab, **Automatic save** should be checked. If there is a crash, these files can be found with an "sv$" file extension. Users should not rely on autosave features. Saving work every 10 to 15 minutes keeps multiple headaches from happening.

Teaching Strategy: *Use VM–D to illustrate an AutoCAD drafting and annotation graphical interface. Then, walk around the room and talk about the graphical user interface and describe where the items are located. [NOTE: The base method is to use a program like SchoolVue to broadcast from the teacher's computer out to the student computers. This allows you to demonstrate directly to each student's computer. If not available, try connecting to a large enough tv or monitor for the class to see your movements.] Use VM–E to illustrate a 3D model of a jig produced using AutoCAD. Assign LS–A.*

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used in the review/summary.

Application. Use the included visual masters and lab sheet to apply the information presented in the lesson.

Evaluation.

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. h
2. d
3. c
4. b
5. g
6. f
7. e
8. a

Part Two: Completion

1. 3D model
2. palette
3. keyboard shortcut
4. space bar
5. 10 to 15
6. quick access toolbars
7. exit (or exit a dialog box)
8. graphical user interface (GUI)

Part Three: Short Answer

Answers will vary, but they should include the following information.

1. Two of the following:
   a. Double-click the CAD program icon on desktop.
   b. Right-click the CAD program icon on desktop and then select **Open**.
   c. Click on the Windows **Start** button and then click on the CAD program.
2. A floating toolbar is an interface that contains tool buttons (in a drop-down list) that the user can display at any location in the graphics window. It can be dragged to new a new location, resized, or docked. A docked toolbar is an interface that contains tool buttons or drop-down lists that are locked to a specific location in the graphics window.
3. The status bar controls a variety of drawing aids and commands, and it is often the easiest way to manage certain drawing settings.

Sample Test

Name _____

The CAD Interface

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. workspace
b. default value
c. command line
d. application menu
e. standards
f. ribbon
g. ToolTip
h. 2D drawing

_____1. An illustration that occupies two dimensions and resides only on the x- and y-axes

_____2. A list of commands relating to the drawing as a whole, such as creating new drawings, opening drawing files, printing, etc.

_____3. A palette that can float, be docked, or be resized, and receive typed commands

_____4. A setting that AutoCAD maintains until the user changes that setting

_____5. A small context-sensitive menu that pops-up when the user hovers over an icon

_____6. A series of tabs organized into panels that contain many of the tools and controls available in toolbars

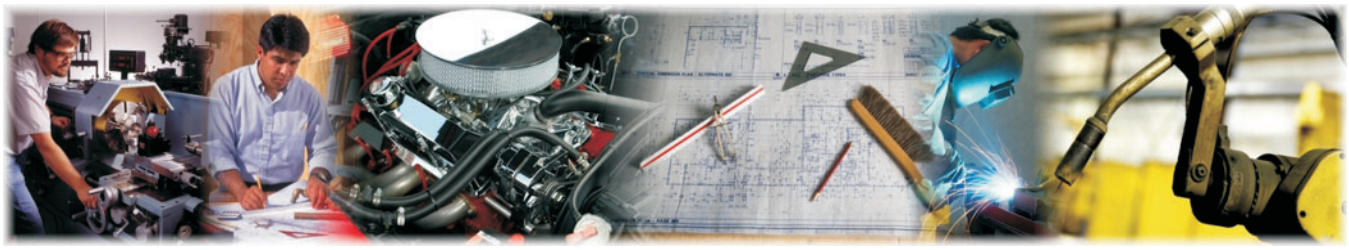
_____7. The guidelines that specify drawing requirements, techniques, operating procedures, record-keeping methods, and appearance

_____8. A preset work environment containing specific interface tools

Part Two: Completion

Instructions: **Provide the word or words to complete the following statements.**

1. A drawing that occupies three dimensions, the x-, y-, and z-axes is a/an _____.



2. A/An _____ is a special window containing tool buttons and features for specific graphics or commands.
3. A/An _____ is a command alias for a complete keyboard entry.
4. Pressing the _____ redeploys the previous command.
5. Save your AutoCAD work every _____ minutes.
6. Interfaces that contain tool buttons representing a CAD command or option, including controls for a variety of drawing aids, are called _____.
7. The function of the [Esc] key is to cancel a command or to _____.
8. An onscreen feature that allows the user to interact with the software: a drafting and annotation workspace active by default when you launch the CAD software and begin a new drawing is a/an _____.

Part Three: Short Answer

Instructions: **Answer the following.**

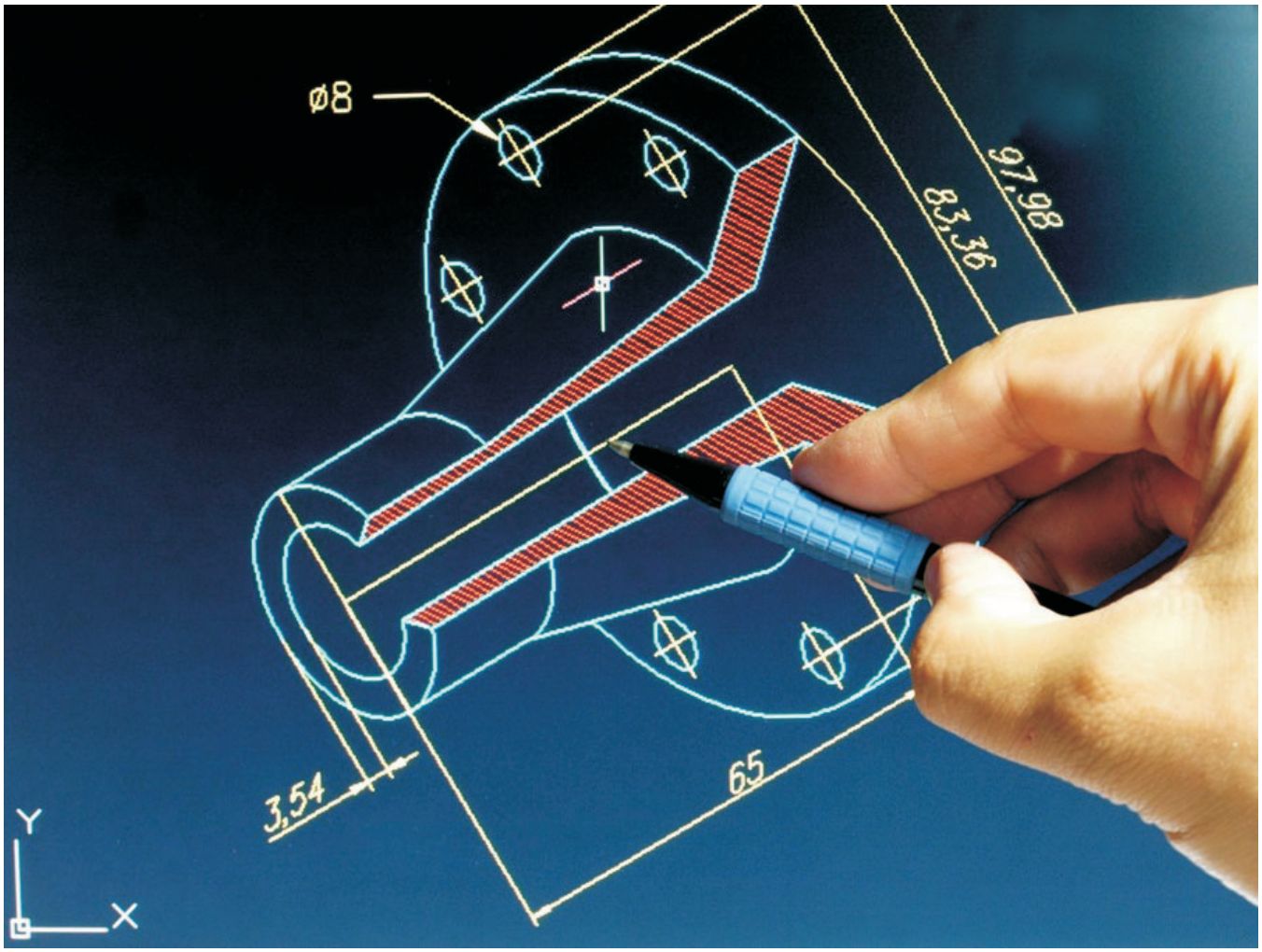
1. List two methods to open AutoCAD.

2. Describe the difference between a docked and a floating toolbar item.

3. Describe the function of the status bar.

2D DRAWING

This engineer is working on a 2D drawing, but due to newer CADD touchscreen software, he is able to draw and change the schematics using a stylus. Imagine what software will provide in 30 years.

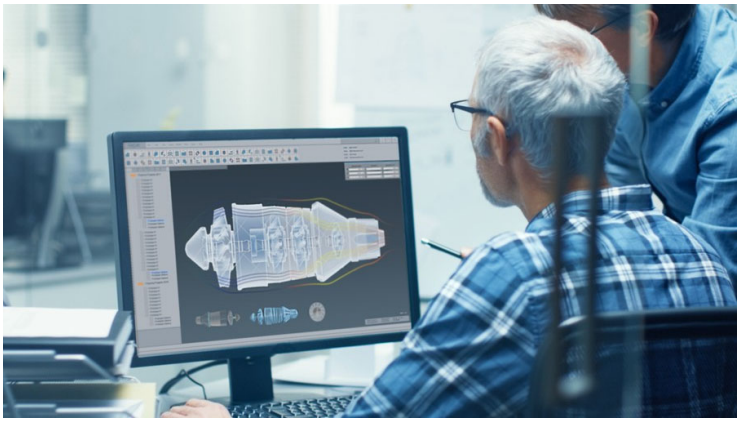


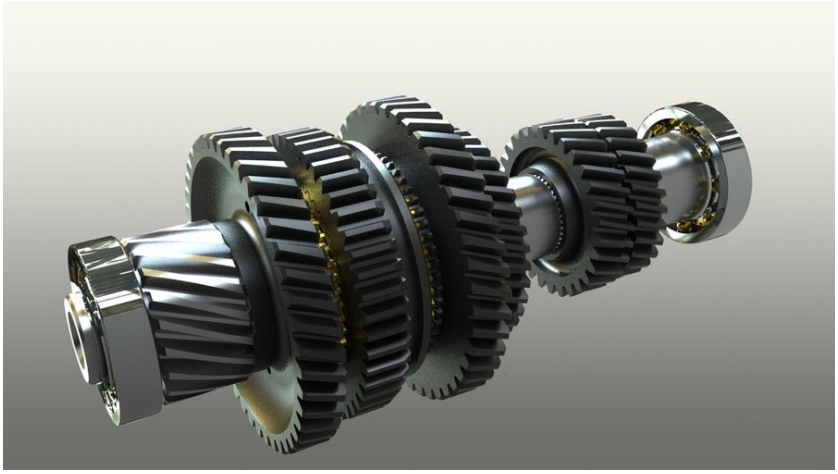
3D MODEL

A 3D model is a drawing that occupies three dimensions, the x-, y-, and z-axes (width, height, and depth respectively).

CAD INDUSTRY APPLICATIONS

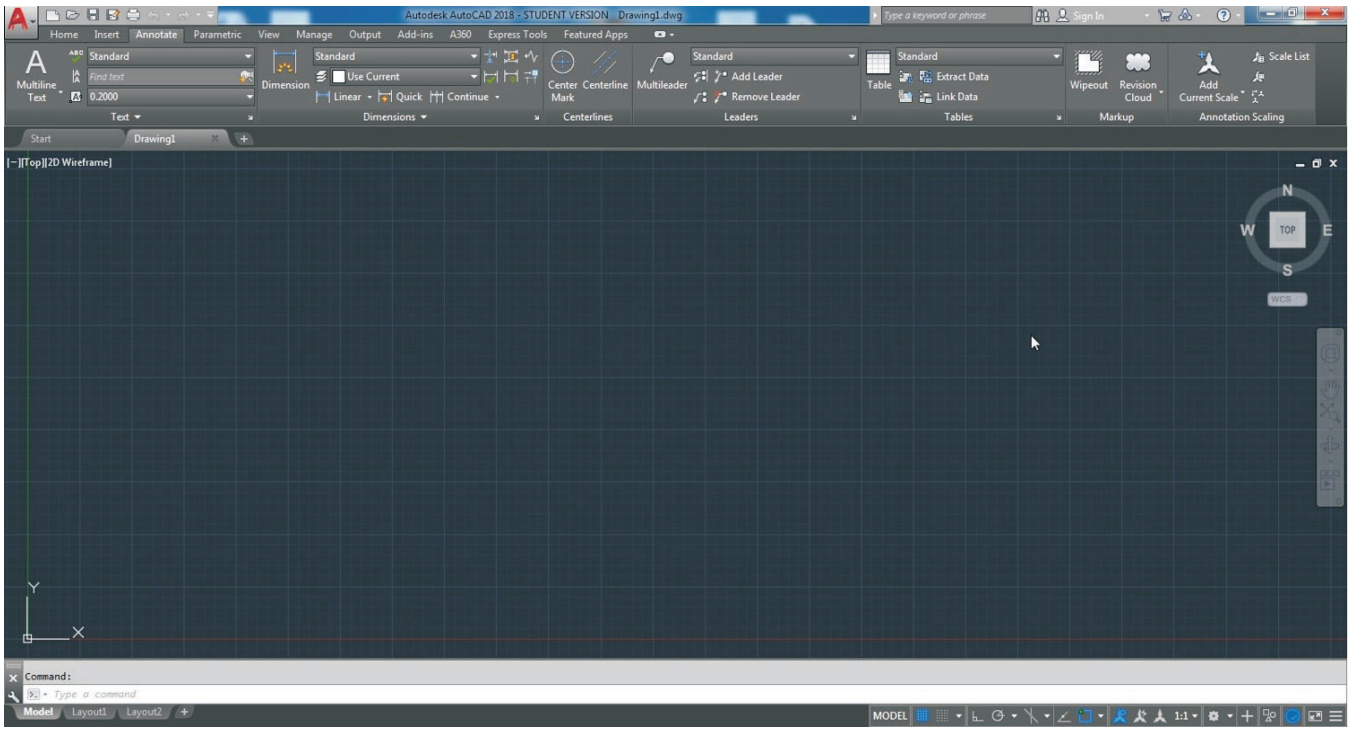
Which industries/manufacturers are represented by these drawings and designs?





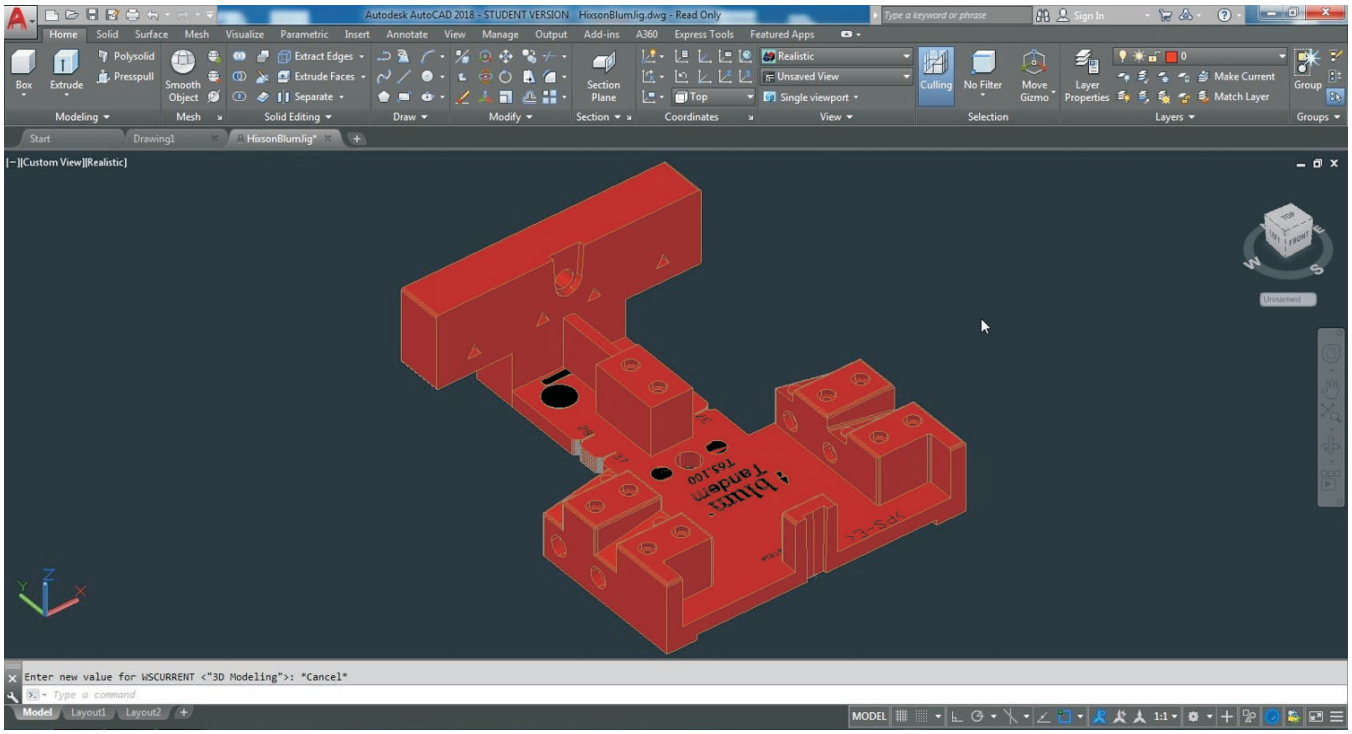
AUTOCAD INTERFACE

This is an image of the AutoCAD drafting and annotation graphical interface. (AutoCAD screen shot(s) reprinted with the permission of Autodesk, Inc.)



BLUM JIG

This image is a 3D model of a jig used to drilled holes on the bottom of a cabinet drawer box. (AutoCAD screen shot(s) reprinted with the permission of Autodesk, Inc.)



Name _____

Label Elements of the AutoCAD Interface

Purpose

The purpose of this lab activity is to correctly label the given AutoCAD interface image.

Materials

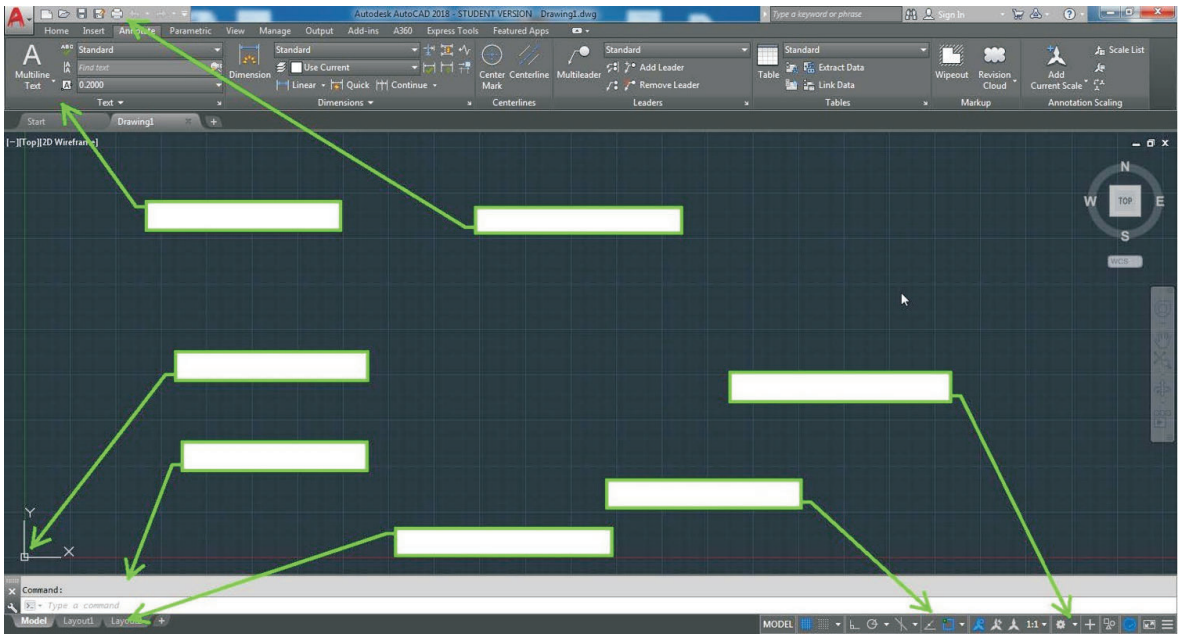
- lab sheet
- pencil or pen

Objective

Correctly label an AutoCAD interface image, and discuss AutoCAD functions with the class.

Procedure

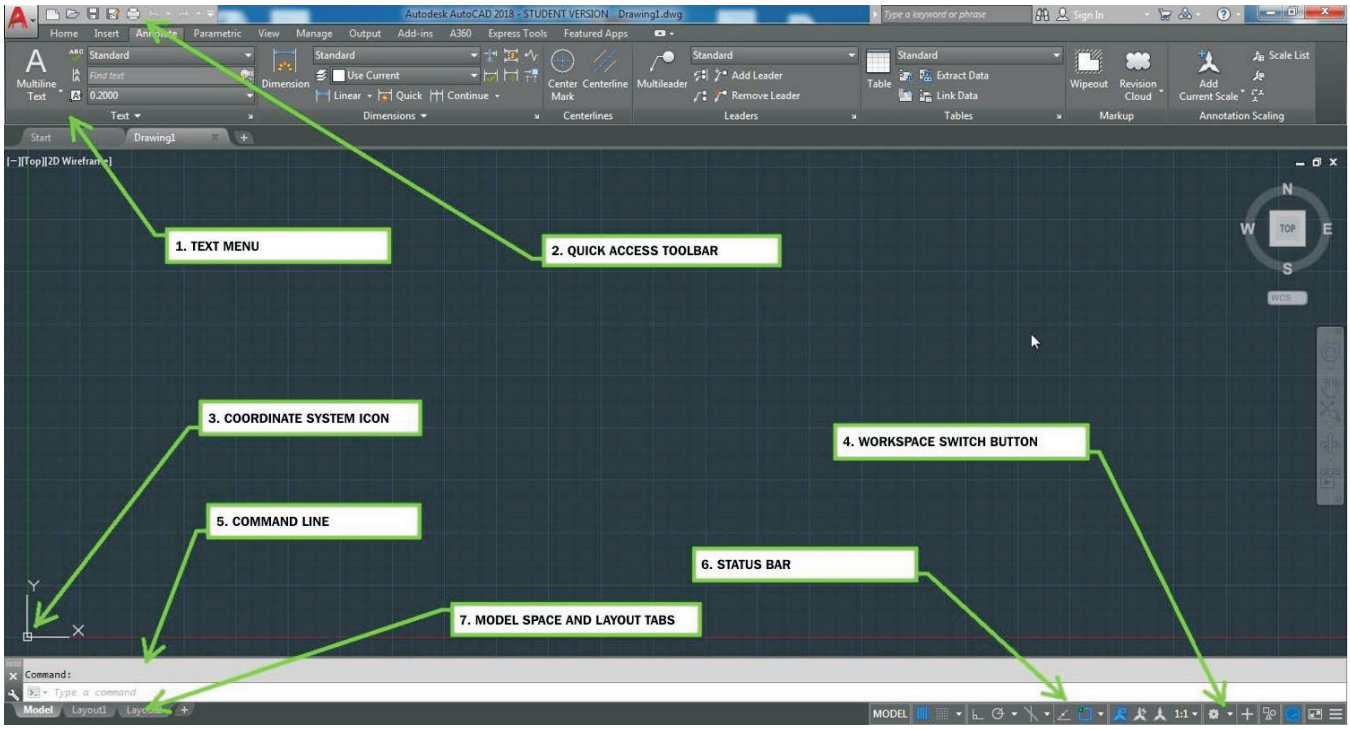
1. Review the AutoCAD interface.
2. Correctly label the following AutoCAD interface image.



3. Participate in a class discussion of the AutoCAD interface functions.
4. Turn in your completed lab sheet and labeled image to your instructor.

(AutoCAD screen shot(s) reprinted with the permission of Autodesk, Inc.)

Label Elements of the AutoCAD Interface



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