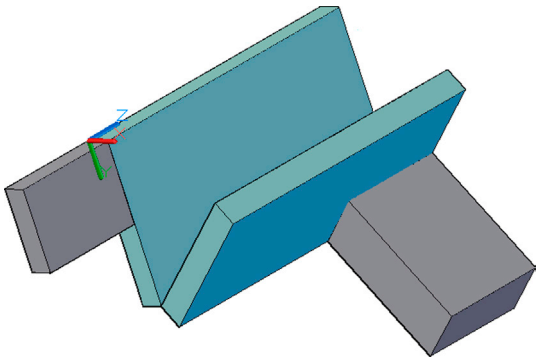
Chapter 28

Advanced UCS, Views, Text, and Dimensions in 3D



Learning Objectives

In this chapter, we complete the design toolbox and expand on your ability to use surfaces of objects to create new shapes. We cover

- Advanced UCS
- UCS
- World
- UCS previous
- Face UCS
- Object
- View
- Origin
- Z-axis vector
- 3 Point
- X, Y, Z
- Apply
- Named UCS
- Views
- Text and dimensioning in 3D

By the end of this chapter, you will be able to create designs regardless of the surface of orientation.

Estimated time for completion of this chapter: 1 hour.

28.1 INTRODUCTION TO ADVANCED UCS, VIEWS, TEXT, AND DIMENSIONS IN 3D

This chapter begins with some additional tools needed to effectively work in 3D space. Advanced UCS refers to additional functionality with the Universal Coordinate Symbol. This symbol is not static in regard to the surfaces with which you work. You can relocate it to a more convenient plane as you see fit to create new design features more effectively.

Up and Running with AutoCAD 2017: 2D and 3D Drawing and Modeling. DOI: http://dx.doi.org/10.1016/B978-0-12-811058-4.00028-1

Once we cover this new functionality, we do a quick introduction to saving views so you can come back and reuse them. This is important in complex designs, where you do not want to continually "reinvent the wheel" after you find new views to work more effectively. Finally, we discuss using text and dimensions in 3D space. Although this is not necessarily different from 2D space, the orientation may throw you off, and some tips and tricks are needed.

28.2 ADVANCED UCS

So far the Universal Coordinate System (UCS) icon has been sitting in the background, acting as a reference point when we need to rotate something about an axis or mirror something about a plane. The icon itself is also rotated occasionally, when we need to draw into another plane. This is all good, but we can make the icon work even harder for us and add some more usefulness to its repertoire. To investigate it further, bring up UCS's two toolbars: UCS and UCS II, as seen in Fig. 28.1. We cover these additional icons (and of course their typed, cascading menu, and Ribbon counterparts).

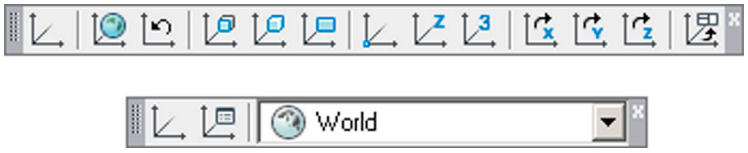


FIGURE 28.1 UCS and UCS II toolbars.

Most of the new commands have something to do with aligning the UCS icon with chosen geometry. This is the central theme in learning UCS's new features. Why is such alignment important? Because this gives you a new "platform" off which to work. Suppose you have an object that is leaning in some direction and you need to draw something else that sits on it. You can draw this new object and rotate it into position, but a better approach is to right away align yourself with the tilted surface and use that as a base from which to draw. All this should tie in with the fundamental theory presented way back in Chapter 21, 3D Basics concerning drawing planes and their rotation. Let us jump right in, and you will clearly see what we are talking about very soon.

First of all, though, we need something on which to practice. The various UCS functions are best understood by just trying them out, so we use the shape in Fig. 28.2 for all UCS demonstrations. Draw a rectangle of any size and extrude it, then rotate3D it some value (perhaps 20°) and mirror3D it for symmetry. The result in the SW Isometric view is shown in Fig. 28.2.

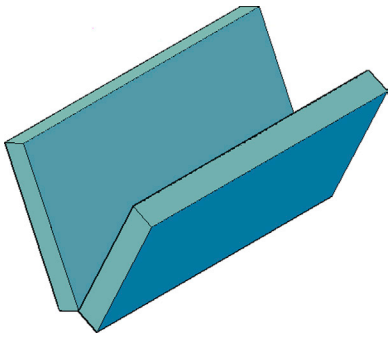


FIGURE 28.2 Basic shapes for UCS practice.

UCS

This first tool presents many options but is primarily used for aligning the UCS via several clicks of the mouse.

Keyboard: Type in **ucs** and press Enter
Cascading menus: Tools→New UCS→Origin
Toolbar icon: UCS toolbar→ 
Ribbon: Home tab→Coordinates 

Step 1. Start the UCS command via any of the preceding methods.
- AutoCAD says: `Specify origin of UCS or [Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis] <World>:`

Step 2. Click somewhere on the object to locate the origin (always using OSNAPs).
- AutoCAD says: `Specify point on X-axis or <Accept>:`

Step 3. Here, you can just press Enter, but if you click on another point, the positive X axis of the UCS icon passes through that point.
- AutoCAD says: `Specify point on the XY plane or <Accept>:`

Step 4. Here, you can again press Enter, but if you click on a third and final point somewhere on the object the Y axis passes through it.

Notice how the UCS is now aligned to the points you indicated. We revisit this a bit later with the Object and 3 Point options. The basic UCS command can also be used to rotate the UCS around any of the axes, although there are actually dedicated icons, as we explore soon.

World

This next tool should be a familiar one, as it "resets" the UCS icon and was mentioned in earlier chapters. The result is that the UCS is returned to the World view from whatever configuration it may have been in previously. Try it out via the following methods.

Keyboard: Type in **ucs**, press Enter, then Enter again
Cascading menus: Tools→New UCS→World
Toolbar icon: UCS toolbar→ 
Ribbon: Home tab→Coordinates 

UCS Previous

This next tool simply returns you to whatever UCS configuration you had previously. It is quite useful if you are using just two settings and need to toggle quickly back and forth. Try it out via the following methods.

Keyboard: Type in **ucs**, press Enter, then **p** and Enter
Cascading menus: Tools→New UCS→Previous
Toolbar icon: UCS toolbar→ 
Ribbon: Home tab→Coordinates 

Face UCS

This next tool is one of two very important alignment tools (the other being 3 Point) that are the core of this section on advanced UCS. Here, you can align your UCS to any face on the screen as long as it is flat. The major advantage here, of course, is that you do not need to know the angle of this face.

Keyboard: Type in **ucs**, press Enter, then **f** and Enter
Cascading menus: Tools→New UCS→Face
Toolbar icon: UCS toolbar→ 
Ribbon: Home tab→Coordinates 

Step 1. Start the command via any of the preceding methods.

- AutoCAD says:

```
Current ucs name: *NO NAME*
Specify origin of UCS or [Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis]<World>:_fa
Select face of solid object:
```

Step 2. Click on any face to which you need to align, and the face is highlighted.

- AutoCAD says: `Enter an option [Next/Xflip/Yflip] <accept>:`

You can easily change the direction of the UCS icon while keeping the 0,0,0 origin in one spot by using the Xflip, Yflip, or Next options before pressing Enter to accept.

Object

This next tool is an interesting variation on Face UCS. Here, you can select almost any object and the UCS icon aligns itself to that object in various preset ways. With an arc or circle, the alignment is to the center; with a line, it is a point closest to where you clicked; and so forth.

Keyboard: Type in **ucs**, press Enter, then **ob** and Enter
Cascading menus: Tools→New UCS→Object
Toolbar icon: UCS toolbar→
Ribbon: Home tab→Coordinates

A full listing of how it reacts is in the Help files. In Fig. 28.3, we see the UCS icon aligned to a few of these objects.

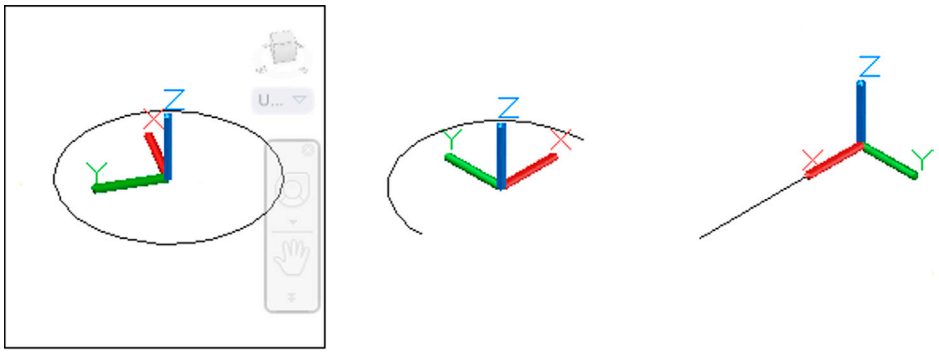


FIGURE 28.3 Object UCS alignment.

View

This next UCS tool establishes a new coordinate system with the XY plane perpendicular to your viewing direction (parallel to your screen).

Keyboard: Type in **ucs**, press Enter, then **v** and Enter
Cascading menus: Tools→New UCS→View
Toolbar icon: UCS toolbar→
Ribbon: Home tab→Coordinates

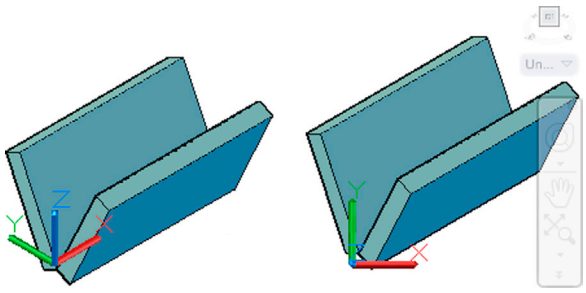


FIGURE 28.4 View UCS.

This is equivalent to going to the Top View while still in 3D, as seen in the before and after screen shots of Fig. 28.4. This technique probably will not be used too often but is the only way to accomplish this if needed.

Origin

This next tool establishes a new origin for the UCS icon.

Keyboard: Type in **ucs**, press Enter, then **o** and Enter
Cascading menus: Tools→New UCS→Origin
Toolbar icon: UCS toolbar→
Ribbon: Home tab→Coordinates

Simply start the command and click anywhere on or near the object; the UCS moves its origin there, as seen in Fig. 28.5. Be sure that the UCS icon Origin option is on, or the icon does not move anywhere.

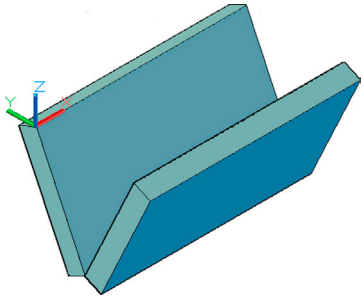


FIGURE 28.5 Origin UCS.

Z-Axis Vector

The next tool simply points the Z axis in a specified direction and is just another way to orient the UCS icon.

Keyboard: Type in **ucs**, press Enter, then **za** and Enter
Cascading menus: Tools→New UCS→Z Axis Vector
Toolbar icon: UCS toolbar→
Ribbon: Home tab→Coordinates

3 Point

This tool is the other extremely useful orientation tool (along with Face UCS). It works on the concept of three points being used to indicate a plane. We present a full demonstration of its use. This demonstration also is relevant to the Face UCS method, as it also orients the UCS to a plane, although in a different way.

Keyboard: Type in **ucs**, press Enter, then **3p** and Enter
Cascading menus: **Tools→New UCS→3 Point**
Toolbar icon: **UCS** toolbar→ 
Ribbon: **Home** tab→**Coordinates** 

Step 1. Start the command via any of the preceding methods.

- AutoCAD says:

```
Specify origin of UCS or
[Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis] <World>:_3
Specify new origin point <0,0,0>:
```

Step 2. Select the three points in consecutive order to define a plane, as seen in Fig. 28.6.

- With each click, AutoCAD says:

```
Specify point on positive portion of X-axis <1.00,0.00,0.00>:
Specify point on positive-Y portion of the UCS XY plane 0.00,1.00,0.00>
```

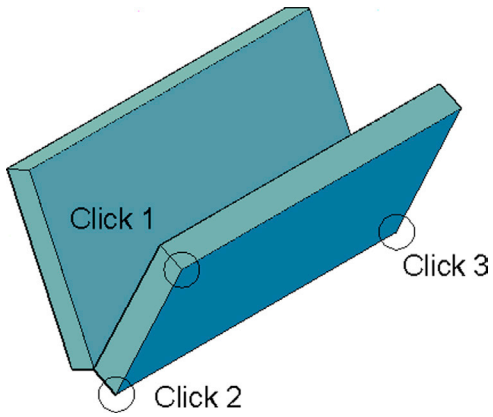


FIGURE 28.6 Refining 3-Point UCS.

When done, the crosshairs and the UCS icon align themselves with the face defined by the three clicks, as seen in Fig. 28.7.

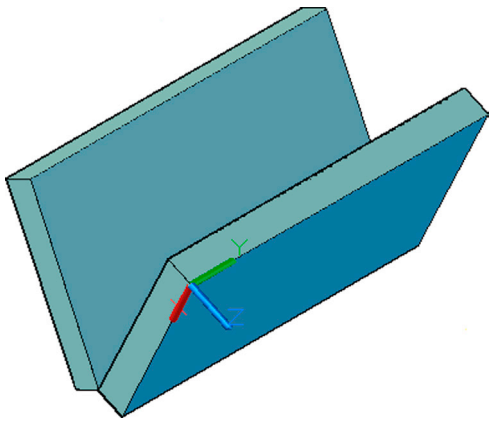


FIGURE 28.7 3-Point UCS.

You can now easily draw something based on that surface, as seen in Fig. 28.8. Performing the same 3-Point alignment and extrusion on the front surface, we have what is shown in Fig. 28.9.

Note that, as mentioned before, Face UCS works the same way, except that you are just selecting the entire face, not defining it as with 3 Point. But, once you establish the new UCS orientation, proceed in the same manner to create new geometry.

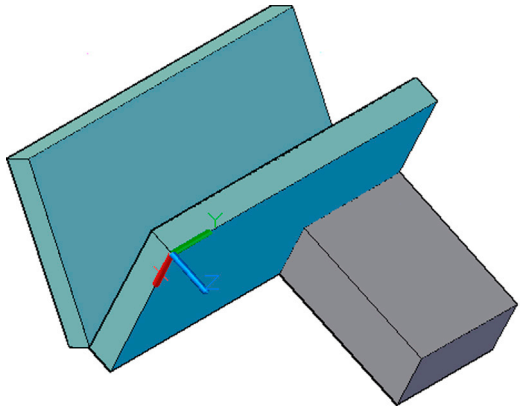


FIGURE 28.8 3-Point UCS, extrusion 1.

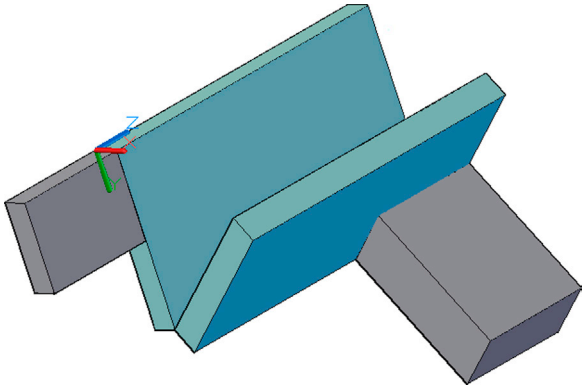


FIGURE 28.9 3-Point UCS, extrusion 2.

X, Y, and Z

These tools are simply icons for the familiar UCS rotation you learned about in the first few chapters of Level 3. Simply press the icons instead of typing in the UCS planes, then enter the angle for the rotation. That is all you need to do, and the UCS rotates accordingly.

Keyboard: Type in **ucs**, press Enter, then **x**, **y** or **z** and Enter
Cascading menus: Tools→New UCS→X, Y or Z
Toolbar icon: UCS toolbar→ 
Ribbon: Home tab→Coordinates 

Taking a look next at the UCS II toolbar, we examine two icons, the Named UCS and the drop-down window next to it. The first icon (UCS) is the same as the one on the previous main UCS toolbar, and we do not go over it again.

Named UCS

If you are going to spend some time with a UCS configured in a certain useful way, you may want to save it in case you need it again. AutoCAD allows you to save as many custom UCS presets as you want. To save a view, do the following:

Keyboard: Type in **ucsman** and press Enter
Cascading menus: Tools→Named UCS...
Toolbar icon: UCS II toolbar→
Ribbon: Home tab→Coordinates

Step 1. Type in `UCS` and press Enter.
- AutoCAD says: `Specify origin of UCS or [Face/NAmed/OBject/Previous/View/World/X/Y/Z/ZAxis] <World>:`

Step 2. Type in `save` and press Enter. The Save option does not appear in the preceding menu, but it works.
- AutoCAD says: `Enter name to save current UCS or [?]`

Step 3. Enter a name for your view, which in this case is just a generic `MyView`, and press Enter.

The new view is now in AutoCAD's memory, saved for future use. It can be found in the UCS dialog box, which is described next.

The dialog box (Fig. 28.10) can be called up via any of the preceding methods. Notice the presence of the highlighted `My_View` UCS setting. You can go to other settings and always go back to it later.

The UCS setting also appears in the toolbar drop-down menu, as seen in Fig. 28.11. This drop-down menu is a convenient way to quickly access not only your custom UCS settings but also the preset ones, including World and Previous.

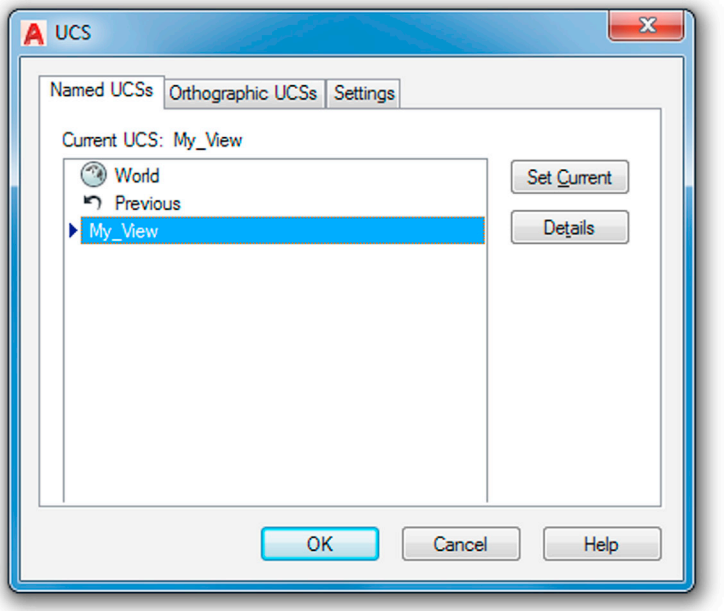


FIGURE 28.10 Named UCS.

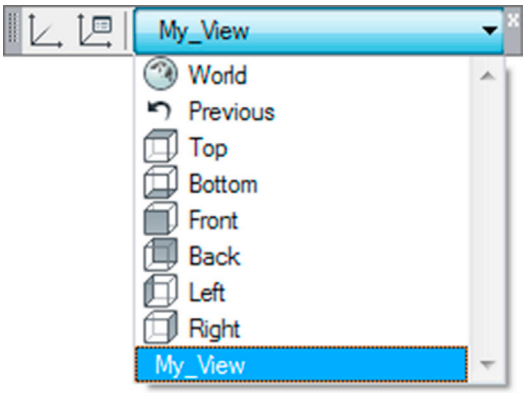
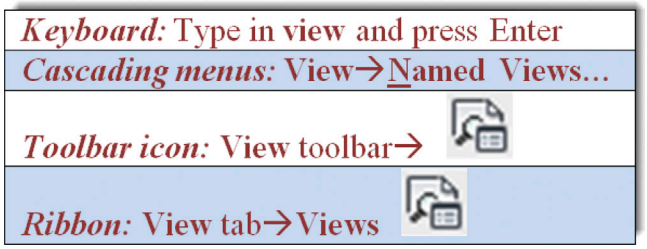


FIGURE 28.11 Named UCS toolbar drop-down menu.

28.3 VIEWS AND VIEW MANAGER

In a closely related topic to saving preset UCS views, you can also save general views of your design. This is a very convenient tool if you find a good view with which to work and may want to come back to later. The views are saved and managed through the View Manager dialog box. Access the command through any of the following methods:



You then see the dialog box in Fig. 28.12. Press the New… button and the New View/Shot Properties dialog box appears, as seen in Fig. 28.13. We are not concerned with the Shot Properties tab for now, so just focus on the View Properties tab. Enter a descriptive view name in the first field and press OK. The name then appears in the View Manager. To retrieve the view, just bring up the View Manager again and double-click on the view you want retrieved.

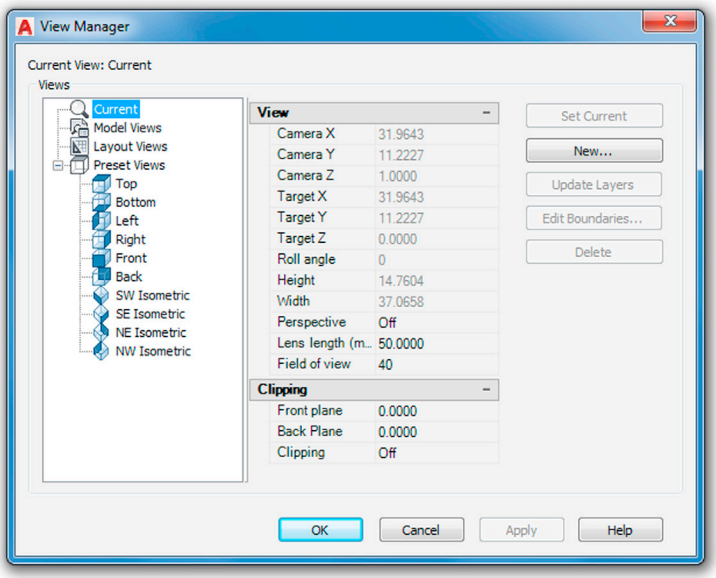


FIGURE 28.12 View Manager.

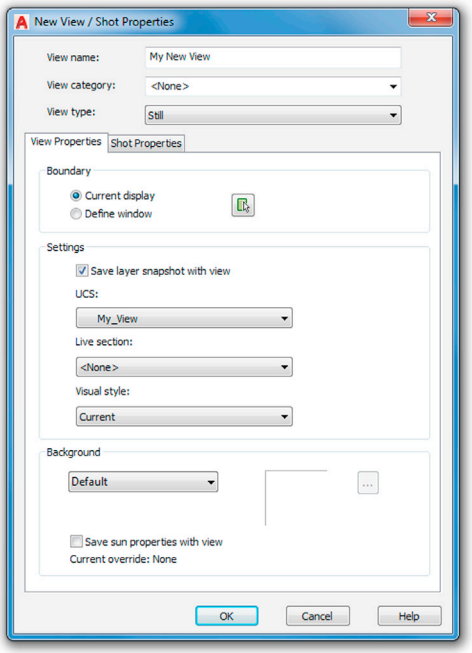


FIGURE 28.13 New View/Shot Properties.

28.4 TEXT AND DIMENSIONS IN 3D

Creating text and dimensions in 3D is not necessarily any different than in 2D; you just use the standard text, mtext, or ddim commands. However, placing them correctly takes some practice because, in 3D, what is up or down is not always clear. You have to pay very close attention to what plane you are on and which way is "up"; otherwise, the dimensions and text appear in the wrong place or the text is inverted. Let us run through a few examples. In each of these cases, pay close attention to everything shown, such as the position of the UCS icon (and the associated crosshairs), as well as the positioning of the dimension and text.

The easiest case is to use the standard World UCS view (SW Isometric) that you are accustomed to in this course. If the Z axis is pointed up, then the dimensions and text come out as shown in Fig. 28.14.

Now, what would happen if we reversed the orientation of the Z axis and it faced down instead? As Fig. 28.15 shows, if we attempt to then add dimensions and text (horizontal or vertical), we are faced with a complete reversal and mirror imaging of the text and dims, which is not the desired outcome.

As this example shows, you have to be very careful about flipping the UCS icon around when dimensioning, as the results may be unpredictable (or at least seem that way). What happens in this example is that you are writing on the other side of the face. So, how do we add dimensions along the Z axis? The next example addresses this.

Let us bring the Z axis back to World view and rotate the UCS icon 90° along the X axis, as seen in Fig. 28.16. Notice the effect this has on horizontal and vertical dimensions.

With these two UCS settings you should be able to dimension just about anything, as the dimensioned cube in Fig. 28.17 indicates, although do not be surprised to run into some difficulties if you are dealing with complex rotated surfaces.

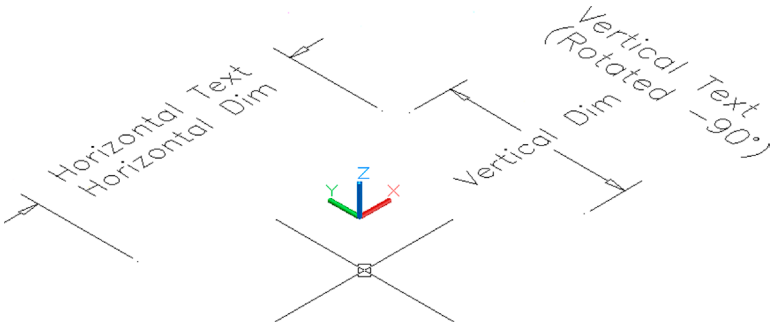


FIGURE 28.14 3D dimensions and text, Example 1.

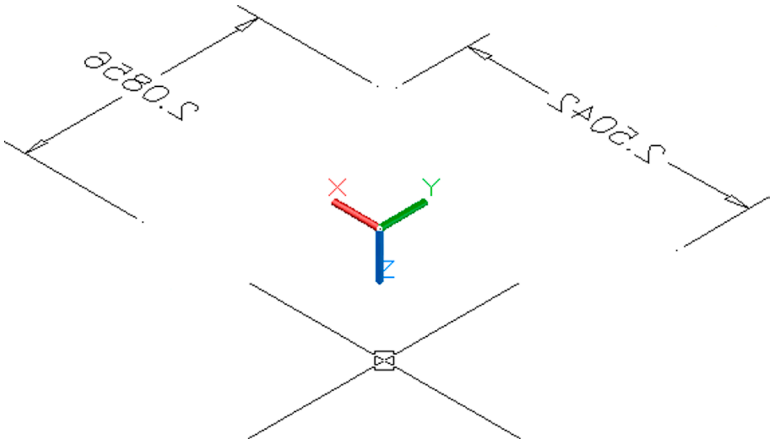


FIGURE 28.15 3D dimensions and text, Example 2.

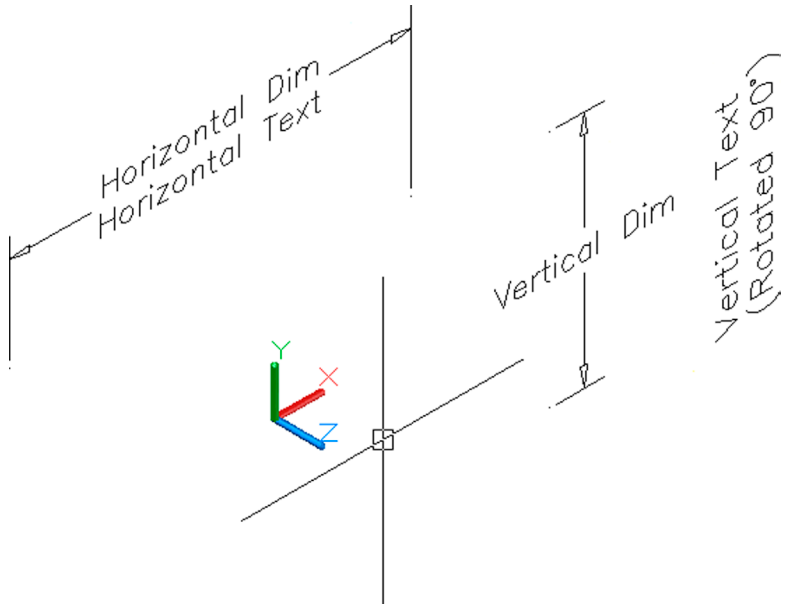


FIGURE 28.16 3D dimensions and text, Example 3.

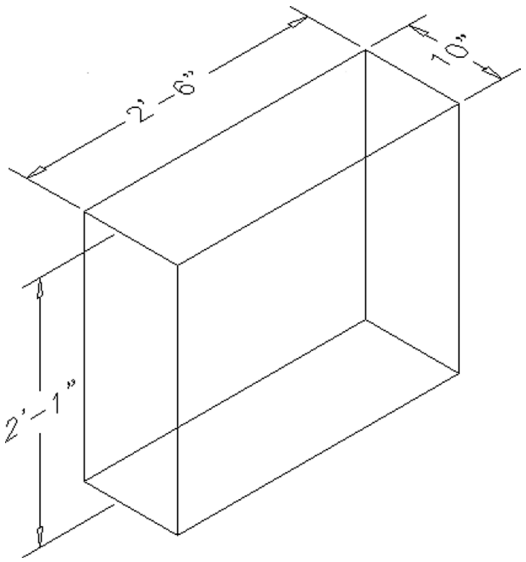


FIGURE 28.17 3D dimensioned cube.

28.5 SUMMARY

You should understand and know how to use the following concepts and commands before moving on to Chapter 29, Dview, Camera, Walk and Fly, Path Animation:

- Advanced UCS
- UCS
- World
- UCS previous
- Face UCS
- Object
- View
- Origin
- Z-axis vector
- 3 point
- X, Y, Z
- Apply
- Named UCS
- View
- Text and dimensioning in 3D

Review Questions

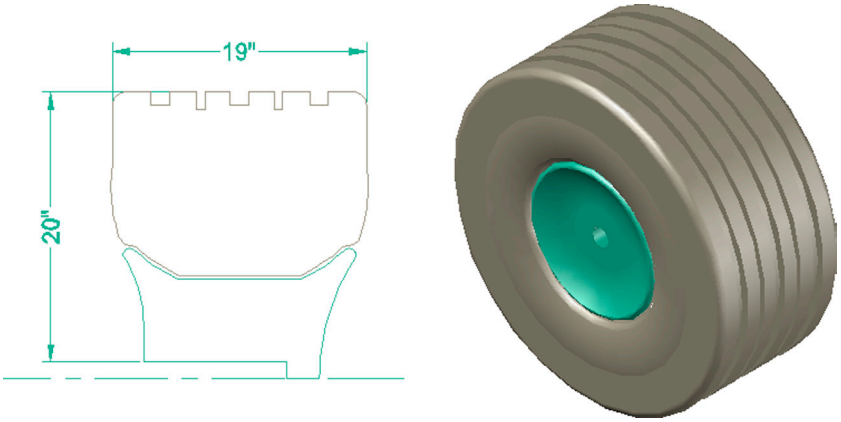
Answer the following based on what you learned in this chapter:

1. List all 13 advanced UCS functions and what they do.
2. What are views useful for?

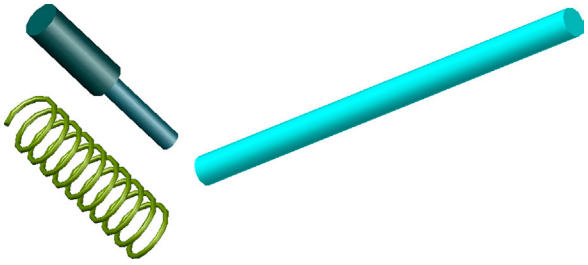
Exercise

1. Create the following fictional 3D suspension and tire model. A breakdown of the parts is shown for clarity, along with hints, but you still need to know the details of creating each part. Some sizing is given, but the focus is on the commands. Use layers. (Difficulty level: Advanced; Time to completion: 1–2 hours.)

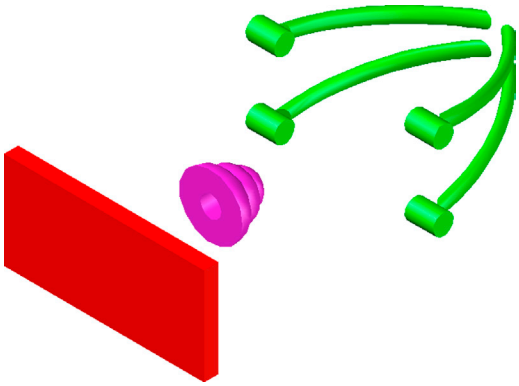
Step 1. Create the tire and rim via plines using the basic sizing as shown. Revolve both around the given centerline 360° for the final shapes shown.



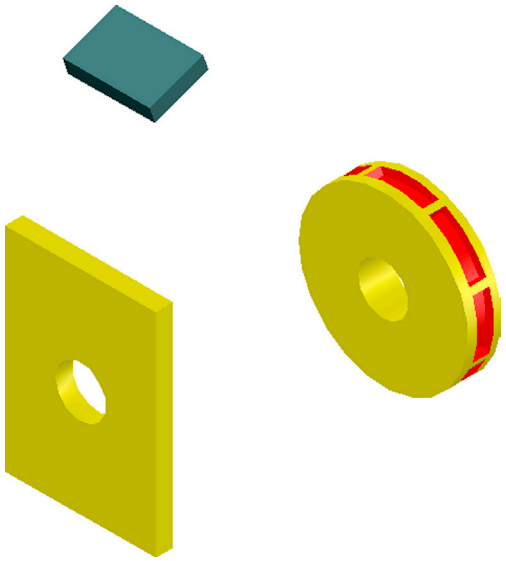
Step 2. The strut is two sets of extruded circles. The coil spring is a helix and was demonstrated in previous chapters. You can choose which method you want to use. The axle is a 50″ long, 3″ diameter extruded cylinder.



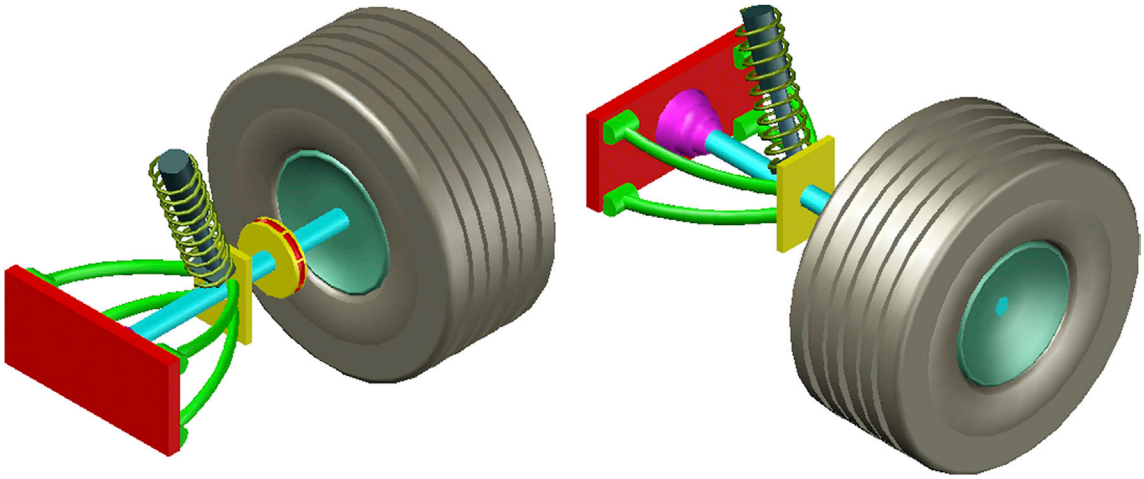
Step 3. The control arms are sweep or path extrusions, your choice. The cylinders are extrusions. For the axle boot, you need to use revolve. The back panel is a 28″ × 13″ × 2″ extrusion.

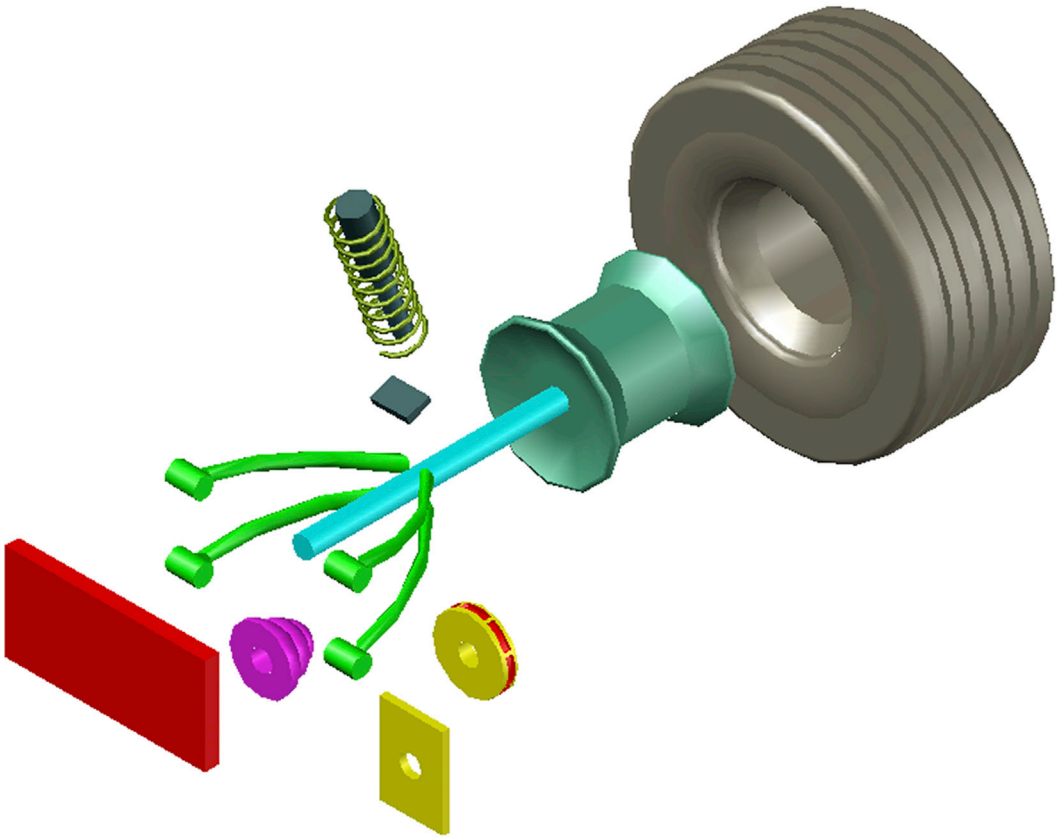


Step 4. The disk brake requires extrusion, subtraction, 3Darray, and other commands. It has a 10″ diameter. Size the rest from that. The panel is about 12″ × 8″ × 1″.



Step 5. The final assembly is shown next. Note that you need to carefully 3Drotate the strut and spring into position, as they are tilted off axis.





Spotlight On: Drafting, CAD Management, Teaching, and Consulting

OVERVIEW

Our final Spotlight On focuses on drafting, CAD management, teaching, and consulting. The first two of these topics may seem like rather odd choices; after all, haven't you been studying them throughout the book? While it is true that you have been learning how to draft and may have even read the appendix dedicated to CAD management (see Appendix: Principles of CAD Management), we really have not discussed what it is like to actually have a career working as a drafter or CAD manager. While all the engineering, architecture, and design professions we profiled earlier are excellent career paths, many students using this textbook began learning AutoCAD to be a drafter, and this is what we focus on. We also look beyond doing drafting to teaching drafting, either in a classroom or in a consultant capacity.

All these topics are very personal to me. While I am working as an engineer right now, I started off my career in the mid-1990s as an AutoCAD drafter and kept at it for 10 years full time (actually double time, you could say, considering the long days I worked). It was not until later in life I returned to engineering and away from pure drafting. Although today I still use AutoCAD regularly and still teach, write, and consult, I will never forget the decade of AutoCAD work, in the trenches of New York City. Drafting, CAD management, consulting, teaching, and corporate training was my life—14 hours per day, 6 days per week. Although one could say that the "Golden Age" of AutoCAD has somewhat passed, with enough qualified candidates finally filling the unending industry demand, it still can be a rewarding and well-paid career.

AUTOCAD TRAINING REQUIREMENTS

The educational requirements for an AutoCAD drafting career are more rigorous now than at the peak of demand, when I got started. Although I had minimal experience back then, I was hired anyway, and the company trained me in-house over a grueling 6 month period; AutoCAD boot camp you could say. Now, 20 years later, this is much less common. You need to attend one of the many community college or tech school programs to get either a certificate or a full diploma in drafting. This can take anywhere from a few months (basic certificate) all the way up to 2 years (for an associate's degree). Either way, you graduate "ready to go" and can be productive at a company right away.

If necessary, take both of the exams offered by Autodesk: Associate and Professional (see Appendix: AutoCAD Certification Exams). However, I consider these exams inadequate in measuring the overall knowledge of an individual. They just are not comprehensive enough. The proof of your skill remains the ability to draft quickly and efficiently, and many companies will sit you in front of a CAD station to draft a given sample. I was on both sides of that fence, doing a few of those and later on devising tests for new hires. Being fast and efficient is still the best way to stand out from the pack. I cannot say it enough—practice your basics!

ARCHITECTURAL DRAFTING

So, what is it really like once you get hired as a draftsperson? This of course depends on where you go. You can draw a line between the world of architecture and engineering. They are different and have their own pros and cons. On your first day on the job, in either profession, you will be shown company standards and given some time to customize your CAD station. Be sure to get AutoCAD looking like you want it. Gone are the days when you shared workstations. You will be on your own computer, so be sure to customize anything that boosts your productivity (`pgp` file, toolbars, etc.).

Be sure to take note of the printer/plotter configurations, and what is available. Be sure to also identify the lead CAD designer or the one most knowledgeable in AutoCAD. Not only are you guaranteed to get stuck on some features of the software, but also you need to know exactly what standards are to be followed—not all of them are enforced, and there may be a reason why. You also need to learn all the network paths and where to retrieve and save drawings.

Day-to-day work at an architecture office revolves around whichever project is assigned to you. In my experience, it is more stressful in architecture, given the deadlines inherent in that profession. Engineering offices in larger companies (such as Siemens and IBM, two companies with which I spent significant time) operate on larger budgets and longer timeframes, giving you a chance to develop additional skills for the job. Architects bill per hour, and you need to be on your game from day one. Expect to see Paper Space and xrefs as a matter of routine. Expect also (in some offices anyway) an emphasis on 3D. More and more architects create computer renderings for clients, often using additional software like Rhino. By and large however, regular 2D floor plans will be your bread and butter. Most architects I worked with used redline markups, basically red ink on a paper printout; and you will quickly learn the meaning of the phrase "he (or she) bled on it." You will take those changes and execute the actual drafting, then print a new sheet for more markups or a final check.

As you gain experience, the architect may allow you to lay out the design or changes to the design, especially if they are routine, then just approve what you do. This is a great way to get to know the profession in case you do want to become an architect. Although I was never interested in an architecture career, somewhere out there exist entire floors in buildings that I designed. Expect to also be out in the field to do surveys or "as-builds." You show up with a camera and pen and paper and take down information, measurement, and pictures to bring back to the office. Sometimes you can bring AutoCAD with you on a laptop, and do the drafting right on the spot.

The money you can earn while drafting for architects is good but not great (except of course at the very top). Drafting time is submitted as part of the overall bid, but generally the allowed rate is not high by the time everything is negotiated. I left architecture after a few years to move to larger engineering companies, with a resulting boost in my pay. To that end, while I was working in architecture offices, I noticed the high rate of turnover in their drafting staff, with exceptions of course. One huge benefit of this type of drafting is the experience you get on AutoCAD. A sizeable architecture project, especially with a 3D component, uses virtually all of AutoCAD's capability. If you have a choice in the matter, start your career in architecture, and then move into engineering drafting. You will gain critical knowledge that will come in very handy if you want to be a CAD manager and for teaching or corporate training.

ENGINEERING DRAFTING

Although this work is not fundamentally different from architecture—you are still using AutoCAD after all—as mentioned, some aspects of the job do change. In my experience, the projects are larger, more complex, and in many ways more diverse. At Siemens, where we worked on the New York City subway's signaling system, the work spanned the mechanical, electrical, and even structural fields. Although my use of AutoCAD was limited to mostly intermediate-level drafting and there was little in the way of 3D modeling, I did have to interact with varying CAD systems and other software. Most of Chapter 16, Importing and Exporting Data was written based on that experience. The money also was far better, as you would expect from a multimillion dollar contract. Keep in mind of course that this was a major firm and engineering work done at a small office is not going to be the same.

Engineering drafting involves the same level of detail as architecture. You may encounter a great deal of electrical schematics, cross sections, and use of attributes to hold information. A lot of our layouts of complex communication equipment were simple from a drafting perspective, same lines, circles, and rectangles over and over again, but complex in its intricacy. When you have thousands of pieces coming together, you have to approach things differently. Use of blocks, nested blocks, and symbol libraries is routine. We had to be very careful in how we presented complex information, which brings us to another major point.

Especially in the engineering world, your job is not just drafting but designing a good layout. It is the next step up from just doing redline markups. You have to constantly take a step back from your drawing and ask if this will be easy to read

by someone who is seeing it for the first time. Use wipeouts to hide what need not be shown (see chapter: Advanced Design and File Management Tools), and use darker outlines for major pieces, reserving lighter lines for the secondary items. Be creative in positioning design elements on a crowded drawing, and always ask yourself: Does this make sense? The purpose of drawings is to convey information. If it fails in that regard, you have not done your job as a draftsperson.

CAD MANAGEMENT

What is meant by CAD management is simply that you are the top draftsperson in the organization and it is your job is to not only draft but also keep an eye on standards, resolve any AutoCAD questions and concerns, and perhaps supervise other draftspersons. No special training is needed, only experience. I spent several years as a CAD manager at Siemens, hiring and overseeing several individuals in that time, one of whom became my business partner in my company, Vertical Technologies Consulting and Design, a few years later.

The key here of course is knowing AutoCAD inside and out and being able to explain to nontechnical managers what the issues are. You also have to be able to give reasonable estimates of how long something will take and any technical hurdles on which you need support. My ability to teach AutoCAD clearly to students was partially honed in my experience explaining issues to managers. You would be amazed how complex and mysterious this software and its abilities can seem to some. As a CAD manager, you will find yourself attending far more meetings than if you were just a draftsperson. Expect to also find yourself teaching others how to do things right.

The final piece of advice for CAD managers is this: Be careful hiring. As described in Appendix E, Principles of CAD Management, the best person to hire is the one that is fastest and most accurate on AutoCAD, as demonstrated by having the person do a simple drawing, such as the floor plan from Chapter 3, Layers, Colors, Linetypes, and Properties. Experience has shown me that if someone does not know an advanced concept, that can be taught in a few minutes. But only extensive time spent drafting can instill speed and accuracy.

TEACHING AUTOCAD

Not everyone enjoys or wants to teach. Teaching is a calling more than a job, though teaching a small group of adult professionals is a far cry from a room full of fourth graders, so we will not pretend it is the same thing. However, it is still very rewarding and a lot of fun. You learn even more about AutoCAD through teaching, because you really have to dissect it for students. I stepped into teaching by accident when, in 1999, a coworker at Liz Claiborne (where we did store planning and design) wanted to go to Europe for the summer after a bad breakup and asked me to fill in for her class at the prestigious Pratt Institute of Design in midtown Manhattan. I do not think she ever came back to the United States, and my temporary teaching gig stretched into many years. I also taught at New York Institute of Technology and other, private, training centers all over the New York City area.

If you think you may want to get into teaching, the best thing to do is to get as much diverse experience as possible. An instructor who has limited experience, even if he or she knows AutoCAD well, just is not able to speak to all the ways AutoCAD is used in the industry. If, however, you have worked across a wide array of specializations and have the patience to teach, this may be for you. Needless to say, you also have to know AutoCAD backwards and forwards. You have to display confidence in your knowledge and confidence while doing public speaking. You will be in front of anywhere from 5 to 20 students at a time.

To get a job teaching AutoCAD you really have to just watch for an opening and drop off your resume at potential schools. Most schools and educational centers want experience, so getting a foot in the door is not easy. It also matters a great deal what type of program you teach. A community college may offer an entire degree in drafting. Then, you have to be a true "educator," possibly with a degree in education, as you would also be responsible for teaching math, science, and maybe technical writing. I always taught in continuing education programs. This is far easier in terms of non-AutoCAD credentials. My students were all adults, and I had to teach only AutoCAD, usually for eight weeks at a time. I preferred this approach, as I did not really wish to teach math and science. This may be the way to go for you as well, if you want to get into AutoCAD instruction, by seeking out these types of programs. They may be part of a university or college, like Pratt or NYIT, or private companies like Netcom, CDM, or RoboTECH, where I taught on and off.

One additional benefit is that the pay is better in these schools than in a full-time teaching position at a college. This is because you work on "contract" and do not get benefits, resulting in a significantly higher base pay. I already had a full-time job in the daytime, with benefits, so this was perfect for me; and I taught in the evenings and often on weekends for many years.

AUTOCAD CONSULTING

The final discussion here focuses on AutoCAD consulting. What is meant by *consulting* is any short- or long-term, and usually highly paid, specialized service that you offer a client. With AutoCAD that can be drafting, but generally you will rarely do that, as drafters can be hired cheaper through placement agencies. Most, if not all, of the consulting that I did refers to corporate training. These were short-term (2- to 5-day) training seminars, also referred to as *boot camps*. They are held at the company's offices and are intense 8- to 9-hour per day classes, meant to educate the engineers or architects in proper use of AutoCAD, as well as problem resolution and optimizing AutoCAD to their specific needs.

This type of consulting is the pinnacle of AutoCAD use and AutoCAD training. You fly or drive to the corporate offices and immerse yourself in an intense, high-pressure environment, teaching a very demanding group of individuals, who paid a great deal of money to have you there, while at the same time giving them ideas on how to best optimize AutoCAD to their business and resolving thorny issues with their current approach. It is not an environment for an amateur, and it took me over 7 years to truly establish myself in this field, with the opening of my consulting firm in 2003. Prior to that, I was sent to these jobs through several private training centers with which I collaborated.

If you wish to get into this type of work, you need to overcome some major hurdles. You have to have absolute mastery of every aspect of AutoCAD, followed by a wide-ranging knowledge of many industries. You could be teaching structural engineers one week and electrical engineers the following week. I once even had the interesting experience of training a squad of FBI special agents assigned to counterterrorism. What did they need with AutoCAD, you ask? They were designing special nonfragmentation concrete barriers to secure a political convention and needed to learn 3D AutoCAD in a hurry. Why didn't they hire a company to create the barriers for them? The work was too sensitive in nature and they needed the product fast; too fast apparently for the lengthy bidding process to find a vendor.

You will also need a solid knowledge of computers, operating systems, and IT networks, as well as have experience on all versions of AutoCAD and LT. You just never know what you are going to get. You have to be willing to travel for a week at a time, often on short notice. The best way to get started is to first partner up with an established training center, then branch out on your own, when you get enough experience. A website advertising your services of course helps a great deal, as does reputation and performance. Most of my clients were repeat business.

Consulting work like this is very well paid. Typical fees for 1 day of work ranged from $1200 to $2200 or more. I typically charged on the lower end of that range (if I did not have to fly to the client), since I had no middleman to pay and wanted to be very competitive. Best of luck to you, in whatever you decide to do!