



Table of Contents

Preface **xiv**

Introduction..... **xxi**

▼ Part One

Digital Reproduction of Technical Illustration

Chapter 1 — Technical Illustration Data and Tools **3**

In This Chapter	3
Chapter Objectives	3
Technical Illustration Defined	4
The Complete Technical Illustrator	5
Computer Graphics and Technical Illustration	6
Technical Illustration Data	6
Raster and Vector Formats	7
Analog Data	8
Raster to Vector Conversion	10
Vector to Raster Conversion	10
Additional Methods	11
Technical Illustration File Types	12
Vector Illustration	13
Raster Illustration	14
Technical Illustration Tools	14
Raster and Vector Products Used in This Book	17
Review	17
Text Resources	17
Internet Resources	18

Chapter 2 — Technical Illustration Reproduction and Workflow Management **19**

In This Chapter	19
Chapter Objectives	20
Analog Reproduction	20
Electrostatic Copying	21
Digital Reproduction	22

Characteristics of Spot and Process Color	23
Specifying Color	25
Characteristics of Digital Displays	27
Printing from the Web	28
Networks and Technical Illustration	29
File Compression	33
Lossless Data Compression	33
Lossy Data Compression	33
Methods of Job Control and Tracking	35
The Beauty of Regular Backups	35
The Job Jacket	35
The Job Ticket	35
Review	36
Text Resources	36
Internet Resources	38
On the CD-ROM	38

▼ Part Two

Technical Illustration Layout and Construction**Chapter 3 — Orthogonal Layout 41**

In This Chapter	41
Chapter Objectives	41
World Axes and Orthographic Views	42
Orthographic Terminology	43
Orthographic Construction Methods	46
Drawing Sheet Size	46
Drawing Scale	47
Layers	47
Grid	47
Snap to Grid	47
Ruler Guides	48
The Zero Well	48
Snap Settings	48
Trimming Tools	49
The Transform Dialog Box	49
Example Using Illustrator's Construction Tools	50
Orthographic Construction Example	53
Determine Appropriate Scale	54
Establish Datums That Control Features	55
Construct Angular Features	56
Complete the Front View	56
Orthographic Views and 2D Illustration	58

Axonometric Projection	58
Axonometric Shearing	58
Perspective Projection	58
Orthographic Views and 3D Illustration	61
Orthographic Views in 3ds max	62
Additional Considerations with 3D Data	63
Review	63
Text Resources	63
Internet Resources	64
On the CD-ROM	64
Chapter 4 — Axonometric Views	65
In This Chapter	65
Chapter Objectives	65
Axonometric Terminology	66
Axonometric and Orthogonal Projection	67
Pictorials, Projections, and Drawings	68
Describing Axonometric Views	68
Axonometric Projection	71
Axonometric Drawing	73
Drawing Axes	75
Axonometric Axes	75
View Axes	77
Local or User-Defined Axes	77
Receding or Thrust Axis	77
Axonometric Views	77
Standard View Methods	79
Shearing Method	79
Scaling Method	81
Viewpoint Method	82
Object Rotation Method	82
Standard Views in AxonHelper	83
Standard Views in Adobe Illustrator	83
Standard Views in AutoCAD	84
Standard Views in 3ds max	85
Review	85
Text Resources	86
Internet Resources	86
Chapter 5 — Axonometric Circles	87
In This Chapter	87
Chapter Objectives	87
The Theory of Ellipse Representation	88

How a Circle Becomes an Ellipse.....	88
Ellipse Exposure	88
Ellipse Geometry	89
Major Axis	89
Minor Axis	90
Thrust Axis	90
Using AxonHelper to Determine Ellipse Exposure.....	90
Determine the Exposure of an Existing Ellipse	92
Ellipse Axes and Perpendicular Thrust.....	93
Measuring with an Ellipse in Adobe Illustrator	95
Create the Underlying Geometry	96
Verify Ellipse as a Measuring Device	96
Create Measuring Ellipses for the Other Sections	97
Scale and Place Circular Sections	98
Complete the Outside Profile	99
Edit for Visibility	100
The Ellipse and Spheres	101
Single and Compound Angles Using Spheres and Ellipses	103
Axonometric Protractors	103
Single Angles	104
Compound Angles	104
Review	105
Text Resources.....	106
Internet Resources	106
On the CD-ROM	106
Chapter 6 — Axonometric Scale Construction	107
In This Chapter	107
Chapter Objectives	107
Views Not Drawn to Scale	108
View Selection	109
Orient Object Geometry to the Axes	109
Create a Correctly Scaled Unitary Cube	110
XYZ Axes Scale and Inclination	111
Construct Correct Ellipses	113
Boxing Out the Crank Weldment	116
Boxing Out the Overall Shape	116
Centerline Construction	117
Scale the Ellipses	119
Complete Tangent Geometry	120
Extrude Geometry to Correct Heights	120
Edit for Visibility	122
Review	123

Text Resources	124
Internet Resources	124
On the CD-ROM	124
Chapter 7 — Axonometric Projection	125
In This Chapter	125
Chapter Objectives	125
The Theory of Axonometric Projection	126
The Axonometric Projection Diagram	127
Use AxonHelper for Projection	128
Projection Methods in Adobe Illustrator	128
Understand Axonometric Projection	129
A Dimetric Example	131
Set the Orthographic Views	133
Set the Views	135
Project the Geometry	137
Solve Angles in an Axonometric Diagram Using Circle Projection ..	139
Review	146
Text Resources	146
On the CD-ROM	146
Chapter 8 — Axonometric Shearing	147
In This Chapter	147
Chapter Objectives	147
The Theory of Axonometric Shearing	148
Geometry That Can Be Sheared	150
Pick a Standard View for Shearing	152
Shear the Views	154
Extrude the Geometry	154
Edit the Geometry	157
Make Planes Renderable	158
Review	160
On the CD-ROM	160
Chapter 9 — Perspective Techniques	161
In This Chapter	161
Chapter Objectives	162
Examples of Perspective Solution	162
Perspective and Axonometric Views	162
Understanding Perspective	166
Comparing Axonometric and Perspective Views	169
Setting Up a Perspective View	170
The Standard 30-60 Perspective Template	170

Use the Template for a Test Perspective	173
Apply Your Perspective Knowledge	178
Perspective without Scale Views—Measuring Points	189
An Example Using Measuring Points	190
Create a Perspective Grid	191
Use a Perspective Grid	196
Perspective in 3D Illustration	200
The Three-Dimensional Camera	202
Review	204
Text Resources	204
Internet Resources	205
On the CD-ROM	205

▼ Part Three**Technical Illustration Rendering**

Chapter 10 — Line Rendering.....	209
In This Chapter.....	209
Chapter Objectives	209
Line Rendering Theory	210
Line Rendering and Reproduction	212
Determine the Thinnest Line Weight	213
Determine the Impact of Reduction	213
Line Rendering Fundamentals	214
Single-Line-Weight Rendering	214
Two-Line-Weight Rendering	215
Five-Line-Weight Rendering	216
Create a Library of Standard Line Styles	219
Using Line Styles	221
Render a Prism	221
Render a Cylinder	222
Render a Cone	222
Render a Sphere	222
Render a Torus	223
Apply Basic Shapes to More Involved Geometry.....	223
Block Shading	224
Hole Shading	224
Sphere Shading	225
Spring Shading	225
Hose Shading	225
Gaps and Hot Spots	225
Step-by-Step Line Rendering	226
A Note about Brushes	228

Variable Line through Duplication	230
Review	232
Text Resources	232
Internet Resource	232
On the CD-ROM	232
Chapter 11 — Photo Tracing.....	233
In This Chapter	233
Chapter Objectives	233
The Theory behind Photo Tracing	234
Autotracing a Photograph	235
Pen Tool Options	235
Pen Tool Practices	237
The Goofy Curve Point	238
Circle Geometry in Perspective	240
Scanning Photographs.....	242
Perspective Geometry.....	243
Create a Vignette Technique	245
Ellipse Axes and Perpendicular Thrust	246
Hexagonal Fasteners	249
Features at Other Angles	251
Line Caps and Joins	252
Line Weight Shading of a Photo Tracing	252
Selective Block Shading	253
Continuous Tone from a Photo Tracing	254
Photo Tracing Examples	255
Taking It to the Limit	257
Review	257
Text Resources	259
Internet Resources	259
On the CD-ROM	260
Chapter 12 — Emphasis with Color	261
In This Chapter	261
Chapter Objectives	262
Illustration Color Space	262
CMYK Color Space.....	262
RGB Color Space	263
Color Models	264
Gray-Scale Color Model	264
RGB Color Model	265
CMYK Color Model	266
Web-Safe RGB	266

Emphasis with Gray-Scale	267
Spot Color	270
Spot Color Swatches	271
Assign the Spot Color	271
PANTONE and Process Spot Color	272
Spot Color and Overprinting	273
Spot Color and Digital Presses	273
Review	274
Text Resources	274
Internet Resources	274
On the CD-ROM	274
Chapter 13 — Color Rendering	275
In This Chapter	275
Chapter Objectives	276
Color in Adobe Illustrator	276
Custom Color Mixes	276
Custom Color Swatches	277
Color Stroke and Fill	280
Color Gradients	283
Blends	283
Line Blends	283
Shape Blends	286
Clipping Mask	288
Pathfinder	289
Gradient Mesh	291
Gradient Mesh Example	292
An Expanded Role for Photoshop	296
The Best of Both Worlds	298
Review	299
Text Resources	299
Internet Resources	300
On the CD-ROM	300
Chapter 14 — PostScript Materials	301
In This Chapter	301
Chapter Objectives	302
Building Libraries	302
Light and Reflected Light	303
Material Characteristics	303
Basic Materials	303
Describing Materials with Color	305
Putting It All Together	305

Chrome Piston	306
Painted Aluminum Shell	307
Rubber Bushing	307
Material Gallery	309
Round Metal Panel With Joint	310
Window/Interior Detail	312
Metallic Textures	315
Transparent Blends	319
Wires, Hoses, and Tubes	321
Review	322
Text Resources	323
Internet Resources	323
On the CD-ROM	324

Chapter 15 — Text and Technical Illustrations 325

In This Chapter	325
Chapter Objectives	325
Typography Primer	326
Digital Typography	328
Fixed-Size Screen Fonts	328
PostScript Screen Fonts	328
Outline Screen Fonts	329
Adobe's Portable Document Format	329
Converting TrueType to Outlines	330
Text from Raster Files	331
Text from CAD Files	333
Text and Color	334
Call-Outs	335
Text in Illustrations	339
Axonometric Text	339
Perspective Text	341
Review	343
Text Resources	344
Internet Resources	344
On the CD-ROM	344

▼ Part Four**Modeling, Animation, and Technical Illustration****Chapter 16—Turning Engineering Drawings into
3D Illustrations 347**

In This Chapter	347
Chapter Objectives	348

The Process	348
Scan the Drawing	349
Align the Scan	350
Place the Scan	350
Lock the Scan	350
Dim the Scan	350
Use Ruler Guides	351
Pull the Centerline Guide	351
Align the Scan	352
Create Profile Geometry	353
Use the Pen Tool	353
Save the File	354
Import the Profiles into 3ds max	355
Import the Adobe Illustrator Vector Profiles	355
Alignment with Axes	356
Assign Intelligent Names	357
Hide Everything But the Pulley and Axis	357
Lathe the Shapes	357
Set the Correct Axis	357
Position the Axis	358
Complete the Lathed Parts	358
Parts That Can't Be Lathed	359
The Balls of the Ball Bearings	360
The Spring	361
The Castellated Nut	362
Arrange Parts on the Axis	362
Rendering the Illustration	364
Line Rendering the Model	365
Continuous-Tone Rendering	365
Review	367
Text Resources	367
Internet Resources	367
On the CD-ROM	368
Chapter 17 — Using AutoCAD Data in Illustrations	369
In This Chapter	369
Chapter Objectives	369
A Note on CAD and CAD Data	370
DXF and IGES Formats	370
An Example of Translating CAD Data	371
The Theory Behind Using AutoCAD	373
Getting AutoCAD Data into Adobe Illustrator	374
Result of COPY-PASTE	375

Result of PSOUT	377
Result of EXPORT	378
Result of Writing to a Plot File.....	378
Result of SAVEIMG	379
File Formats in AutoCAD	379
Isometric Pictorials in AutoCAD	379
2D Drawings from 3D Data in AutoCAD	380
Viewpoint and Rotation Data from AxonHelper	380
AxonHelper	380
Viewpoint	380
Rotation	383
Rendering in AutoCAD	385
Perspective Camera Views in AutoCAD	385
Editing in Illustrator	386
Standard Views in 3ds max	387
Review	390
Text Resources.....	390
Internet Resources	390
On the CD-ROM	390
Chapter 18 — Modeling for Illustration	391
In This Chapter	391
Chapter Objectives	392
When to Model from Scratch	392
Considerations When Modeling	394
Rule of Least Complexity	394
Rule of Fewest Elements	394
Rule of Smallest Printer Dot.....	394
Rule of Viewer Field	394
Rule of the Rendering Engine	395
Geometric Analysis	395
Your Modeling Environment	396
Work on Paper	396
Work in Views	396
Set Model Scale Units.....	396
Save Start-up Files	397
Work with Appropriate Axes	397
Work in Separate Files	397
Modeling with Primitives	397
Lathe a Profile about an Axis	398
Extrude a Profile along an Axis	400
Create or Import the Profile	400
Extrude the Thickness	400

Make the Other Aileron	401
Loft a Profile Following a Path	402
Create Shape and Path	402
Loft the Shape	403
Convert the Loft to a Mesh	404
Edit the Loft Elements	404
Patch Surfaces	405
Create the Patch Surface	405
Edit the Patch	407
NURBS Surfaces	408
Create the NURBS Curves	408
Create the Side Profile	408
Create Copies of the Original NURBS Curve	409
Scale the NURBS Curves	410
Shape the NURBS Curves	410
Attach the Curves	410
Create the NURBS Surface from the Curves	411
Boolean Operations	412
Create the Tool	413
Perform the First Subtraction	414
Perform the Second Subtraction	414
Boolean Intersections	415
Finishing Up	416
Modeling from Life	417
Review	421
Text Resources	422
Internet Resources	422
On the CD-ROM	423
Chapter 19 — Raster Materials	425
In This Chapter	425
Chapter Objectives	426
Raster Graphics	427
Bitmap	427
Bit Depth	427
Color Palette	427
Rendering Methods	429
Flat Shading	429
Gouraud Shading	430
Phong Shading	430
Ray Tracing	431
Raster File Formats for Materials	431
Windows Bitmap (BMP)	431

Graphic Interchange Format (GIF)	432
Joint Photographic Experts Group (JPG)	432
Targa Graphics Adapter (TGA) Format	432
Tag Image File (TIF) Format	432
The Material Editor	432
Basic Materials	433
Textures	434
Diffuse Maps	434
Bump Maps	438
Opacity Maps	440
Environment Maps	442
Complete the Mapping	442
The Tires	443
The Propellers	444
The Engine Nacelles	445
The Wings	447
The Fuselage	448
The Tail	448
The Completed Illustration	450
Materials and Lights	450
Omni Lights	450
Target Spotlights	450
Target Direct Lights	450
Rendering Raster Images	452
Quick Render First	452
Set Individual Cameras	453
Animate the Camera	453
Final Rendering	453
Review	455
Text Resources	456
Internet Resources	456
On the CD-ROM	456
Chapter 20 — Animation and Technical Illustration	457
In This Chapter	457
Chapter Objectives	458
Effective Technical Illustration Environments	458
Animation's Function in Technical Illustration	460
Animation File Formats	461
Graphic Interchange Format (GIF)	461
Audio Video Interleave (AVI)	462
QuickTime (MOV)	462
Motion Picture Expert's Group (MPEG)	462

FLASH	462
Animation Cameras	462
Light the Animation	465
Plan the Animation	466
Step 1: Key Frame the Action	466
Step 2: Plan the Action	466
Step 3: Execute the Animation	467
Finish the Animation	467
Render the Animation	467
Use the Animation	468
The Pulley Example	470
Create an Environment	470
Design the Animation	471
Set Up the Animation	472
Key Frame the Parts	473
Work in the Top View	475
Render the Animation	476
The Beaufighter Example	477
Make the Physical World	477
Set Natural Lights	477
Set a Camera	478
Apply Materials	479
Render the Camera View	479
Cloud Shadows	480
Distance Terrain	481
Runway and Associated Roads	483
Airport Buildings	484
Set Animation Parameters	486
Review	487
Text Resources	487
Internet Resources	487
On the CD-ROM	488
Glossary	489
Index	498