

Table of Contents

I	Dragonfly Overview	1
1	Introduction	3
1.1	Goals	3
1.2	Game Engine Overview	4
1.3	Test Your Knowledge	10
2	Setup	13
2.1	Development Environment	13
2.2	Dragonfly Header Files	14
3	Tutorial	15
3.1	Overview	15
3.2	Text-based Graphics	17
3.3	Saucer Shoot	18
3.3.1	Startup	18
3.3.2	Saucers	20
3.3.3	Hero	25
3.3.4	Bullets	29
3.3.5	Reticle	32
3.3.6	Explosions	34
3.3.7	End of Game	36
3.3.8	Nukes	37
3.3.9	Game On!	38
3.3.10	Stars	41
3.3.11	Polish	43
3.3.12	Audio	47
3.3.13	Final Touches	49
3.3.14	Where to From Here?	50
3.4	Test Your Knowledge	51
II	Dragonfly Design and Implementation	53
4	Engine	55
4.1	Overview	55
4.2	Managers	57

4.2.1	Singletons	60
4.3	Logfile Management	61
4.3.1	Variable Number of Arguments	61
4.3.2	Human-friendly Time Strings (optional)	62
4.3.3	Flushing Output	63
4.3.4	Conditional Compilation	64
4.3.5	The LogManager	65
4.3.6	Controlling Verbosity (optional)	67
4.3.7	Test Your Knowledge #3	69
4.3.8	Development Checkpoint #1!	70
4.4	Game Management	71
4.4.1	The Game Loop	71
4.4.2	Measuring Computer Time	73
4.4.3	The Clock Class	75
4.4.3.1	Fine Tuning the Game Loop (optional)	77
4.4.4	The GameManager	78
4.4.5	Test Your Knowledge #4	80
4.4.6	Development Checkpoint #2!	81
4.5	The Game World	82
4.5.1	Game Objects	83
4.5.1.1	The Vector Class	83
	Other Vector operators (optional)	85
4.5.1.2	The Object Class	85
4.5.2	Lists of Objects	86
4.5.2.1	List Iterators (optional)	90
	ObjectList Iterators (optional)	92
4.5.2.2	Overloading + for ObjectList (optional)	93
4.5.2.3	Dynamically-sized Lists of Objects (optional)	94
4.5.3	Test Your Knowledge #5	96
4.5.4	Development Checkpoint #3!	96
4.5.5	Updating Game Objects	97
4.5.6	Events	99
4.5.6.1	Events in Dragonfly	103
4.5.6.2	Step Event	104
4.5.6.3	Casting	105
4.5.7	The WorldManager	107
4.5.7.1	Deferred Deletion	110
4.5.7.2	The Update Phase	111
4.5.8	Program Flow for Game Object Lifetime	111
4.5.9	<i>Dragonfly</i> Testing	112
4.5.10	Test Your Knowledge #6	114
4.6	Development Checkpoint #4 – <i>Dragonfly</i> Egg!	116
4.7	Sending Events	118
4.8	Display Management	119
4.8.1	Simple and Fast Multimedia Library – Graphics	119

4.8.2	The DisplayManager	123
4.8.2.1	Color	123
4.8.3	Using the DisplayManager	129
4.8.4	Drawing Strings	130
4.8.5	Drawing in Layers	131
4.8.6	Colored Backgrounds (optional)	133
4.8.7	Test Your Knowledge #7	133
4.8.8	Development Checkpoint #5!	134
4.9	Input Management	136
4.9.1	Simple and Fast Multimedia Library – Input	137
4.9.1.1	SFML – Polled Input (optional)	139
4.9.2	The InputManager	139
4.9.2.1	Keyboard Event	142
4.9.2.2	Mouse Event	143
4.9.3	Test Your Knowledge #8	145
4.9.4	Development Checkpoint #6!	145
4.10	Kinematics	146
4.10.1	Collisions	149
4.10.1.1	Collidable Entities	153
4.10.1.2	Collision Event	154
4.10.1.3	Collisions in the WorldMananger	155
	Disallow Movement onto Soft Objects (optional)	158
4.10.1.4	World Boundaries – Out of Bounds Event	158
4.10.2	Program Flow for Moving Objects	159
4.10.3	Test Your Knowledge #9	160
4.11	Development Checkpoint #7 – <i>Dragonfly</i> Naiad!	161
4.12	Resource Management	163
4.12.1	The Frame Class	163
4.12.2	The Sprite Class	165
4.12.2.1	Transparency (optional)	169
4.12.3	The ResourceManager	170
4.12.3.1	Loading Sprites	173
4.12.3.2	Sprites with Robust Formatting (optional)	177
4.12.4	Test Your Knowledge #10	182
4.12.5	Development Checkpoint #8!	183
4.12.6	Using Sprites and the Animation Class	184
4.12.6.1	Transforming Sprites (optional)	186
4.12.7	Test Your Knowledge #11	189
4.12.8	Development Checkpoint #9!	190
4.13	Boxes	190
4.13.1	The Box Class	190
4.13.2	Bounding Boxes	191
4.13.3	Utility Functions (optional)	196
4.13.4	Views	197
4.13.4.1	Advanced View Control (optional)	202

4.13.4.2	Using Views	203
4.13.5	Test Your Knowledge #12	204
4.13.6	Development Checkpoint #10!	206
4.14	Audio	207
4.14.1	Simple and Fast Multimedia Library – Audio	207
4.14.2	<i>Dragonfly</i> Audio	208
4.14.2.1	The Sound Class	208
4.14.2.2	The Music Class	209
4.14.2.3	Extending the ResourceManager for Audio	211
4.14.3	Using Audio	213
4.14.4	Test Your Knowledge #13	213
4.14.5	Development Checkpoint #11!	213
4.15	Filtering Events (optional)	214
4.15.1	Program Flow for Events	222
4.15.2	Test Your Knowledge #14	223
4.15.3	Development Checkpoint #12!	223
4.16	View Objects	224
4.16.1	View Event	230
4.16.2	Buttons (optional)	232
4.16.3	Text Entry (optional)	236
4.16.4	Test Your Knowledge #15	240
4.16.5	Development Checkpoint #13!	241
4.17	End Game (optional)	242
4.17.1	Scene Graphs (optional)	242
4.17.1.1	Inactive Objects (optional)	248
4.17.1.2	Invisible Objects (optional)	251
4.17.2	Test Your Knowledge #16	253
4.17.3	Development Checkpoint #14!	253
4.17.4	Gracefully Shutting Down (optional)	254
4.17.4.1	Closing the Game Window (optional)	255
4.17.4.2	Catching Ctrl-C (optional)	255
4.17.5	Random Numbers (optional)	257
4.17.6	Splash Screen (optional)	259
4.17.7	Test Your Knowledge #17	267
4.18	Development Checkpoint #15 – <i>Dragonfly</i> !	267

III Dragonflying 271

5	Debugging 273
5.1	Debugging Help 273
5.1.1	Five-step Debugging Process 274
5.1.2	Prevention 275
5.1.3	Debugging Tips 275
5.2	Common Bugs in Dragonfly 276

5.2.1	Undefined Constructor in Base Class	277
5.2.2	Vtable Errors	277
5.2.3	Time System Call Errors	277
5.2.4	Header Definition Errors	278
5.2.5	Personality Errors	278
5.2.6	Syntax Errors	278
5.2.7	Makefile/Project File Errors	279
5.2.8	Segmentation Faults	279
5.2.9	Redeclaration of Classes	280
5.2.10	Static Arrays Too Large	280
5.2.11	Deleting Statically Allocated Memory	281
5.2.12	Sprite is Invisible	281
5.2.13	Collisions Do Not Occur	282
5.2.14	Errors using LogManager writeLog()	282
5.2.15	Errors compiling SFML	282
5.2.16	Errors running SFML	283
6	Taking Flight	285
6.1	Testing	285
6.1.1	Overview	285
6.1.2	Types of Tests	286
6.1.3	Unit Tests	287
6.1.3.1	Unit Test Manager	288
6.2	Particles	291
6.3	Lines of Code	294
7	Projects	297
7.1	Project 1 – Catch a <i>Dragonfly</i>	297
7.2	Project 2 – <i>Dragonfly</i>	298
7.2.1	<i>Dragonfly</i> Egg	299
7.2.2	<i>Dragonfly</i> Naiad	299
7.2.3	<i>Dragonfly</i>	300
7.3	Project 3 – <i>Dragonfly</i> Spawn	301
7.3.1	Plan	301
7.3.2	Alpha	301
7.3.3	Final	302
8	Bibliography	303
	Acknowledgments	305
	About	307
	Appendices	308
A	<i>Dragonfly</i> Header Files	309