



# **Building a Pinball Machine**

**Gooligan's Hooligans**

**(project GH2006)**

**by**

**Terry Cumming**

# What I will blab about

- **Background**
- **How to design and make a machine**
- **Gooligan's Hooligans and my experiences**
- **Advice to other crazy people**
  
- **Many topics to cover – can't get too in-depth**

# Background – Epic Pinball

- **1993 Epic Megagames project**
- **PC shareware game**
- **Pot of Gold**
- **Fish Tales, Wizard, Expressway heritage**



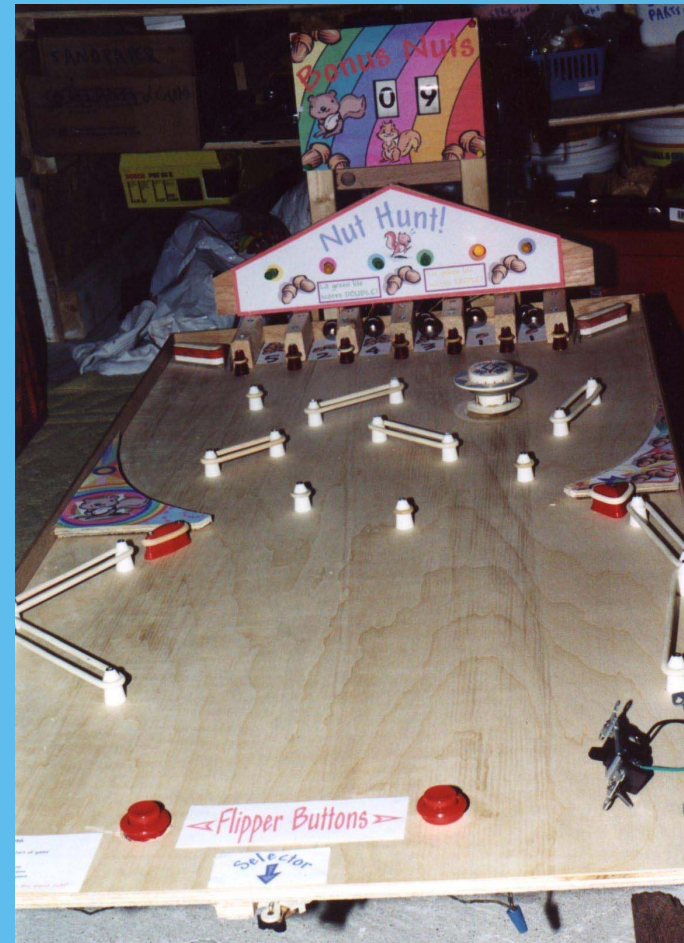
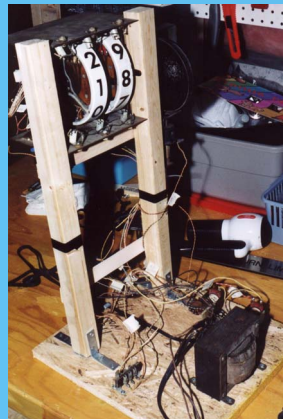
# Background – Extreme Pinball

- **Extreme Pinball**  
**1993 – 1996**
- **PC and Playstation**
- **Rock Makers**
- **Monkey Mayhem**
- **Urban Chaos**



# Background – Nut Hunt!

- **Nut Hunt! EM rolldown – flipper game 2001**
- **Finally had room to build something!**



# Background – Solar Ride 2004

- Learned electronics
- 2004-2005 project
- Basic Stamp, BasicX, Picaxe controllers
- Win98 laptop with Java
- New rules, old p/f



# **Gooligan's Hooligans many lives**

- **Originally the 4<sup>th</sup> Extreme Pinball table**
- **Extreme Pinball for Windows 1<sup>st</sup> table  
(project cancelled for Unreal)**
- **Symbian OS cell phone game (UK  
programmer went MIA)**
- **Real game 2006-2008! Fourth time lucky**

# Make a game - Focus

- **Tell you my experiences with GH2006**
- **Discuss methodologies and techniques**
- **Relive horror stories and nightmares**
- **Go through the steps**
- **Opinions and insights**

# Make a game – G2 Platform

- **Solar Ride 2004 – Platform gen 1 (G1)**
- **Gooligan's Hooligans based on gen 2 (G2)**
- **G2 uses single Atmel AVR Atmega32 - 8mhz.**
- **Support for 48 switches, 48 lamps, 16-32 coils, PC audio and display**

# Make a game – AVR

- **Atmel code written in C – all s/w FREE**
- **AVR Studio to develop & test code and load micro controller**
- **Olimex JTAG dongle for program loading**
- **WinAVR tools for compilation and AVR Studio integration**

# Make a game - AVR

- **AVR supports 38kbps serial transfer to PC**
- **Strobes lamp matrix**
- **Scans switch matrix**
- **Fires and releases coils**

# Make a game - Java

- **G2 Java code an evolution of code from G1 and SR2004. All tools FREE**
- **Game config read from XML files**
- **Implements all game rules, handles all switch events**
- **Fires coils, flashes lamps, plays sounds, updates LCD display, writes logs**

# Make a game - Java

- **Heavy use of timers to control asynchronous events**
- **Producer – consumer queues to decouple real time events from consumer non-RT OS (XP)**
- **Powerful console to issue commands, execute macros, mess with stuff**

# **Make a game – H/W**

- **Electronic circuits designed and PCBs made**
- **Eagle (free) for schematics and PCB layouts**
- **Olimex in Bulgaria for fabrication**
- **PCB costs \$30 - \$60 each**
- **Buy lots of components, connectors, WIRE!**
- **Test on breadboards first then PCBs made**

# **Make a game – P/F**

- **11.5mm Baltic Birch – less than 1/2 inch!  
Washers galore ...**
- **Gottlieb cabinet and supporting h/w**
- **Forstner bits & brad point bits for holes**
- **Jigsaw and filing for ellipses, squares**
- **Hans for routing lamp inserts and shooter  
lane**

# **Make a game – P/F**

- **Original p/f layout scale pencil drawing**
- **Converted to SVG – Inkscape**
- **25 hours programming to parse PostScript and emit DWG to import to TurboCAD 11**
- **2D drawing**
- **Export WMF to Corel Draw 12 for art**

# Make a game – P/F

- **Vector graphics for art plus bitmap images**
- **Art printed on transparent vinyl**
- **Blew it! Needed white on wood. Who knew?**
- **Awesome results otherwise – easy to apply with care**

# Make a game – P/F

- **With art on, build up p/f FINALLY!**
- **Spend \$\$\$ on ebay buying used assemblies**
- **Time consuming, rip offs, stuff you don't need, go out of control**
- **Test major mechanisms (flippers - kickers)**
- **Learn coil math and predict coil strength (25V versus 50V systems)**

# **Make a game – P/F**

- **Make p/f rotisserie using Beaver pattern (\$60 in Home Depot parts)**
- **Wire up lamps, switches, coils**
- **18ga, 22ga & some 16ga. Use correct wire!**
- **Over \$200 in wire used**
- **Tools!**

# Make a game - Backbox

- **Build adapter to hold LCD monitor**
- **Stuff PCBs in back**
- **Build front frame to make it look OK**
- **Filing tray for speaker grilles!**
- **Add artwork like video marquee**

# **Make a game – Cab Art**

- **Sanded then spray painted cabinet w/Rustoleum**
- **Mediocre results, long time to cure**
- **No artist so 1940s/50s Crime Comics used**
- **Scan cool frames and edit. Print on vinyl**
- **Use what you have at your disposal**

# **Make a game – BG Art**

- **Crime comics + other images used as source**
- **Create file in Corel Draw, export to TIFF**
- **Print on translucent vinyl adhered to Lexan**
- **Clear Lexan in front then add edge clips**
- **Duratrans better option if price works out**
- **Illumination via 6V #47 lamps**

# Make a game - Wiring

- **Long periods on rotisserie**
- **Get cable lengths correct! Mine too short**
- **Lots of Molex connectors and crimping**
- **Colored electrical tape to get more colors**
- **Staple gun and zip ties for neatness**
- **Build wiring “highways” through coil hills**

# Make a game - Playing

- **100s of games to test p/f layout and rules**
- **Many post adjustments and tweaking**
- **Problems remain – need 2<sup>nd</sup> prototype ☹️**
- **Adjustments never stop**
- **If I don't shoot at something, make it worth more. Will I go for it then?**

# Make a game - Playing

- **Is it fun? Comply with design rules of the masters? Balanced?**
- **Will it keep me interested for a long time?**
- **Will my kids like it?**
- **Keep rule complexity down. Player should always understand – not just the code**
- **Simple objectives but hard to obtain**

# Make a game - Playing

- **Lots of top 10 lists maintained**
- **Globally and for each player**
- **Kids were crazy for Solar Ride 2004 trying to move up on Top 10 list**
- **Game-scoped versus ball-scoped goals**

# Make a game - Audio

- **Lots of code written for streaming WAV and MP3 files**
- **Short sound clips and MIDI also supported**
- **Multi-channel stereo for free**
- **Add GBs of background music and attract mode songs**
- **Audacity used for speech recording/editing**

# Make a game - Tools

- **Wire strippers 16-26ga and cutters (ICs)**
- **Big wire cutters (steel, aluminum)**
- **Crimping tools (Molex). See Clay's site**
- **Long-handled screwdrivers! Bench vice**
- **DMM, oscilloscope**
- **Calipers, files, punches, jumper wires, rivets**
- **PROJECT LOG!!!**

# Make a game - Advice

- **Be realistic with expectations**
- **Don't fixate on super cool toys**
- **A journey of n miles starts with a single step**
- **Pinball rotary club – electrical engineer, coder, artist, sound guy, designer, woodworker, metalworker, mech engineer**
- **Start with old wired p/f**

# Make a game - Advice

- **Look at kits and what's happening now**
- **Snow Mountain DIY game, NuCore, Nuggy**
- **Pick a platform you can get parts for**
- **How much do you want to do yourself?**
- **Be realistic on time frame (1-5 years)**

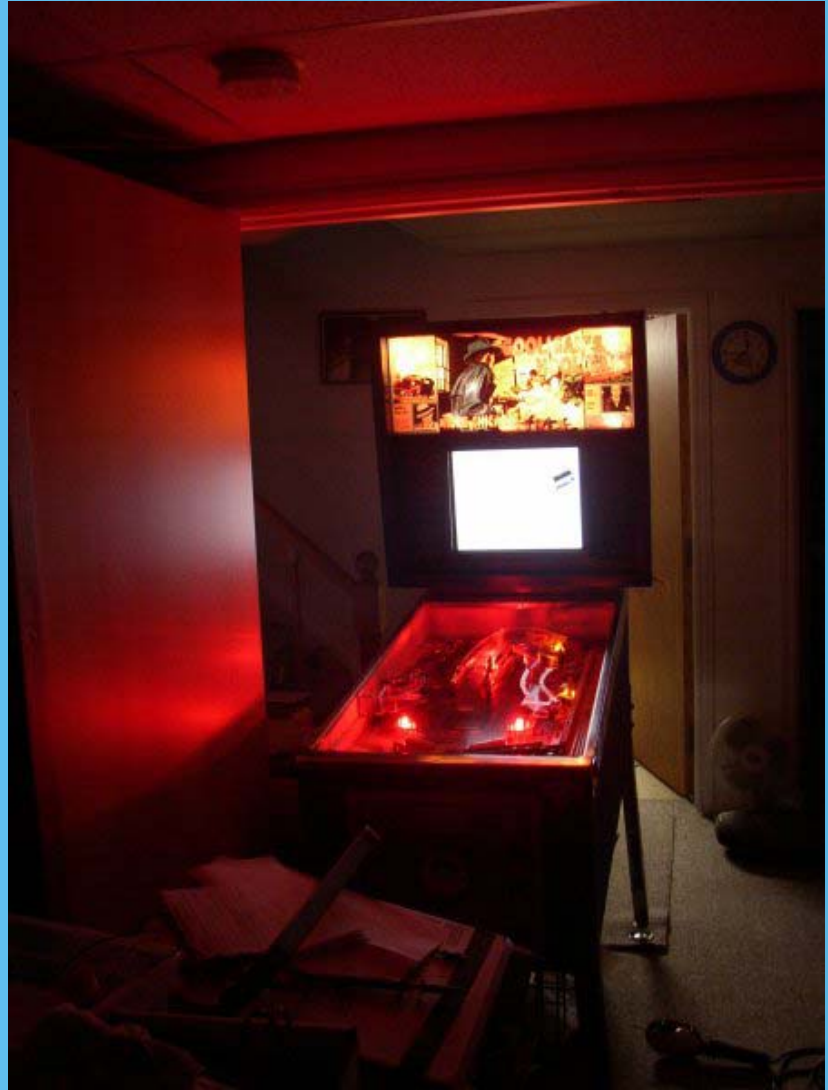
# Other Folks

- **Brent, Coldwater ON Canada, AC/DC**
- **Broz, Mtl, Nebula**
- **Scott Elder, Batman**
- **Evan K, WA, Futurama**
- **Nuggy, Aus, Coconut Island**
- **Snow Mountain, Col, Creepy Crypt**
- **Other too + dev platforms: NuCore, FPGAs**

# The ultimate irony

- **Gooligan's Hooligans started as a virtual game as part of a PC simulation package**
- **Today GH is a real game capable of running from within the PC game from which it originated ...**

# The work continues



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