FIREPOWER

INTERVIEW WITH EUGENE JARVIS

GAMOGRAPHY

"The only legitimate use of a computer is to play games."

Year	Game	Manufacturer	Type		Year	Game	Manufacturer	Type
1976	The Atarians	Atari	Pinball		1988	NARC	Williams	Videogame
1977	Time 2000	Atari	Pinball		1990	Smash TV	Williams	Videogame
1977	Airborne Avenger	Atari	Pinball		1990	High Impact Football	Williams	Videogame
1978	Space Riders	Atari	Pinball		1991	Strikeforce	Midway	Videogame
1979	Superman	Atari	Pinball		1991	Super High Impact	Midway	Videogame
1980	Firepower	Williams	Pinball		1992	Total Carnage	Midway	Videogame
1980	Defender	Williams	Videogame		1994	Cruis'n USA	Midway	Videogame
1981	Stargate	Williams	Videogame		1996	Cruis'n World	Midway	Videogame
1982	Robotron 2084	Williams	Videogame		1999	Cruis'n Exotica	Midway	Videogame
1983	Blaster	Williams	Videogame		2004	Target: Terror	Raw Thrills	Videogame
1984	Space Shuttle	Williams	Pinball		2004	The Fast and the Furious	Raw Thrills	Videogame
1986	High Speed	Williams	Pinball		2006	TFATF: Superbikes	Raw Thrills	Videogame
1987	F-14 Tomcat	Williams	Pinball					

Q: First up, before we get onto the techie stuff, could you give some insight into how you got into the industry / Williams and what your background is?

A: I was a pinball player and computer science student at Berkeley, California in the 1970's. I loved playing the classic Gottlieb electromechanical games, and I was a total addict on Space Wars which ran on an old IBM 704 mainframe on campus. I also was into the homebrew computer scene in the Bay Area, and it was there I was turned on to the potential of microcomputers when Jobs and Woz brought in their Apple 1 proto. I cut my programming chops on the Cray designed CDC 6400 mainframe, and the Intel 4004 micro. So when I graduated I jumped at a chance to interview at Atari as a programmer in their new solid state pinball department.

Q: Also what was it like at Williams (and Atari before that) back in pinballs heyday?

A: Atari was an amazing place back in the Bushnell days. There was a cowboy gunslinger type attitude that anything was possible. It was clear that the micprocessor revolution in games was just starting and opening up whole new universes in game design. Bushnell would come down to engineering and wax philosophically on the new hoirzons in gaming. We totally ate it up. And by throwing out the past of pinball, the relays, the chimes, etc, we made some really cool games with amazing special effects for their time. Flashing lights, synthesized audio, amazing artwork by George Opperman, etc. But as Thomas Edison put it – invention is 1% inspiration and 99% perspiration. You really need solid engineering to back up the dreamers, and in the pinball area there is a lot of nuts and bolts and mechanics and power electronics that need to be worked out. Sadly this is where Atari fell short, and the games tended to break down and literally catch on fire. We pushed the envelope too far.

Q: Can you talk a little about how you pushed the boundaries of pinball sound development – from Superman's sound programs to developing G-Wave and then onto micro processors.

A: Its amazing, but I knew nothing about sound when I started at Atari. But by working with the very crude wave table synthesizer we used there, I became enthralled with how sound effects are really the soul of a pinball. The ball is the conductor and the sound program is the symphony. The right sound could magnify the players emotional involvement in the game, and transport the player into a the fantasy world of the game.

In the late '70's Atari shut down the pinball division, and I followed Steve Ritchie to Williams. At Williams, the sound system did not use a hardware synth as virtually all other game companies used, but rather a dedicated 1 Mhz 6800 micprocessor tied to a 8-bit DAC. Randy Pfeiffer pioneered this design and showed its power in the Steve Ritchie 1978 pin "Flash". You could in principle make any sound possible, you just had to program it and fit all the data into 2 Kbytes of ROM, and 128 bytes of RAM along with all the other sounds and program. The obvious solution is to just record the desired sound effect and play it back – like todays IPOD. Unfortunately, at the standard sample rate of 44Khz, the 2 kbytes would last for about 50 milliseconds of sound. Good enough for one short bird chirp. So the trick was to create sounds that could be mathematically expressed into a very small amount of data, or a very compact algorithm. And this gets to the basis of what sound really is. It is just a string of numbers converted to audio energy. So the challenge to the sound programmer is to generate very interesting strings of numbers to the human ear.

Actually I started working with the Williams sound board on the pin "Lazer Ball". On this game the memory was only 512 bytes for all program and data. It was this extreme memory crunch that inspired the Gwave wave table synthesizer. By storing a waveform (sine, square, triangle,etc.) in 4-64 bytes, and then a frequency table of 10-20 bytes, a sound could be characterized by a few bytes. To get further mileage, echo, distortion, LFO,and white noise systems were also employed at a cost of only a few extra bytes. Being the creator of Gwave, I was able to make some really cool sounds, but as skilled as I was, I was stunned to find out that the most brilliant sounds were often created by typing in random numbers for the parameters. Often incredible sounds were generated by inputting mathematically undefined values, such as echoing a sound "0" times. The crudeness and lack of bounds checking of the program allowed for mathematical wraparound and error accumulation that sounded ethereal. For Firepower, I also constructed a parametrically driven pulse width modulation synth – that was responsible for the background sounds and also several of the signature spacey type effects. This sound package went on to form the basis for sound at Williams throughout the '80s – powering the classic series of Defender, Stargate, Robotron, Sinistar, and Joust, as well as the pinballs all the way through High Speed, for which I added an FM synthesis module.

INTERVIEW WITH EUGENE JARVIS (continued)

Q: In terms of the sound programming, Firepower was one of the first pinballs to have continuous, immersive background sound. How did this come about? What technical challenges did this present and how were you able to resolve them?

A: The background sound was the brainchild of Steve Ritchie and Randy Pfeiffer the team that created the pinball "Flash". Flash was really the pinball that ushered in the golden age of solid state pins – with its pioneering audio, light, and flashlamp effects, not to mention kick-ass gameplay. This was the game that inspired me to come to Chicago. The inherent technical challenge of the background sound is that the Williams sound synth was essentially monophonic due to processor speed limitations. It could only make one sound at a time! Therefore an elaborate sound priority system was employed that would play the highest priority sound for each instant in time, the background sound being the lowest priority or default sound. The challenge was further exacerbated by the need to save state for interrupted sounds – all in 128 bytes of Ram.

Q: In terms of design, how closely did you work with Steve Ritchie in the design of Firepower? Were there aspects that you had to nix because of the limits of the technology?

A: Steve is undoubtedly the greatest innovator in pinball design in the modern era. He was always pushing the envelope of the possible, and notoriously burned out many a programmer. Steve and I were a very collaborative team, and we constantly traded ideas in both the mechanical and electronic realms. Our idea for Firepower was inspired by the classic Bally electromechanical multiball "FireBall" from the early '70s, the razzle-dazzle electronic theatrics of "Flash", and the all consuming gameplay mania of Space Invaders.

At the time the programming and failsafe logic needed to make the multiball system work was very challenging. Looking back in hindsight now it seems almost trivial. The logic was a beautiful thing in the way multiple players "shared" locked balls. I think the only thing that was nixed was use of mechanical moving targets and drop targets due to reliability considerations. It is very hard for a broken game to be a great game.

Q: For me, the introduction of solid state microprocessors meant us serious pinball players didn't lose out on points scored – was this a complex to programme?

A: Actually this was trivial. The real work was to delay the scoring so you could hear every ten point or hundred point sound. Essentially emulating an electromechanical machine's relays and score motors.

Q: What about the "animation" using the 6 digit displays on Firepower, wasn't the countdown idea "a first" that was copied in other games -eventually leading to alphanumeric animation (M-A-G-N-A-S-A-

V-E and other effects on BK2K, for example) and finally whole shows and mini videogames played on the DMD?

A: Firepower was the first game to have a special effect in the score display. It was a big deal at the time, since up to that point the score was constantly displayed. Players were concerned that their score would "go away" and be lost somehow in cyberspace. Luckily the code was robust and no one was cheated, only entertained! Firepower opened the pandoras box of display effects and was the final death knell of score reel emulation.

Q: I know it's a Firepower site, but I can't resist asking about F-14 Tomcat...

A: F-14 Tomcat! has awesome flashers, sounds and gameplay and really gets the feeling of it's theme going...the ball launches with sounds and lightshow and the way it moves around the playfield is interesting for player and observer. *(Eugene is credited with both Sound & Software - and for me we're back to the total pinball package again, where the game has become more than the sum of the parts. - ed)*

Tomcat was Firepower on steroids! Four balls instead of three, 23 flashers instead of 2, 3 rotating Mars lights up top. The Mars lights were so obnoxious, that some bars would put buckets on top of them to tone down the military hysteria. It was amazing. The playfield was based on an unfinished Ritchie layout many years earlier that was actually the original "Hy Speed" yes it had a "Y" ! The game is definitely one of the fastest pin tables ever created. I did most of the software and many of the sounds, and I had some great partners on that game. Chris Granner of Pinbot fame did an virtusoso job on the Yamaha synth chip both with effects and music composition. His original country rock multiball theme, and General Yagov suspense theme rock out - and the "Anchors Aweigh" landing arrangement is fabulous.

The unforgettable Mark Ritchie as voice of the redneck pilot. Ed Boon, co-creator of legendary video fighter Mortal Kombat made his programming debut on the display effects for F-14. I like to think I taught him everything he knows! I just love how the theme worked out so well, as the balls became fighter planes; they launched from the fighter deck, shot down General Jagov, crashed when they drained, and "landed" for the final achievement. Firepower is probably greater as a purists' pingame, but the gratuitous overkill of F-14 is perhaps the ultimate Jarvis-Ritchie extravaganza.

Q: Finally, which particular aspect of your involvement in the development of what is, after all, one of the best pinballs in terms of design and playing pleasure, are you most proud of?

A: As awesome and novel is the effects and programming package on Firepower, to me the greatest acheivement is the game itself. It is is case where excellence in each element of game design; mechanics, layout, theme, artwork, and program all combine to overcome disbelief and transport the player into the machine. The goal to achieve multiball becomes all consuming, and despite the brute viscousness of the game, and the inevitable crushing of the players ego, it is an amazing challenge full of agony, and with perseverance and skill – VICTORY!!!!!

http://www.rawthrills.com

APPENDIX A: Pinball credits

The Atarians (Atari)
Date: 1976 (November)
Theme: Fantasy
Game Type: Widebody Pinball
MPU: Atari Generation 1 (M6800 @ 1 MHz)
Design: Bob Jonesi
Art: George Opperman
Software: Eugene Jarvis, Fred Yates
Sound: Eugene Jarvis
Notes: First Atari pinball, first SS widebody game, first game to use inductive under-playfield sensors instead of rollover switches. Four flippers.

Time 2000 (Atari)
Date: 1977 (June)
Theme: Fantasy
Game Type: Widebody Pinball
MPU: Atari Generation 1 (M6800 @ 1 MHz)
Design: Marty Rosenthal
Art: Jim Kelly, George Opperman
Software: Eugene Jarvis
Sound: Eugene Jarvis
Notes: Notable for artwork and the interesting use of flippers. Four flippers.

Airborne Avenger (Atari)
Date: 1977 (September)
Theme: Fighter Pilot
Game Type: Widebody Pinball
MPU: Atari Generation 1 (M6800 @ 1 MHz)
Design: Steve Ritchie
Art: George Opperman
Software: Eugene Jarvis
Notes: Left kickback which appears later on Firepower. Two flippers.

Space Riders (Atari)
Date: 1978 (September)
Theme: Fantasy - Space/Motorcycles/Future
Game Type: Widebody Pinball
MPU: Atari Generation 1 (M6800 @ 1 MHz)
Artwork: Gjalt Vanderwyk, George Opperman
Software: Eugene Jarvis
Notes: Custom Sound Chip. Two flippers.

Superman (Atari)
Date: 1979 (March)
Theme: Superhero
Game Type: Widebody Pinball
MPU: Atari Generation 2 (M6800 @ 1 MHz)
Design: Steve Ritchie
Artwork: George Opperman
Software: Eugene Jarvis
Sound: Eugene Jarvis
Notes: License tie in with DC Comics. Custom Sound Chip. Two flippers.

Firepower (Williams, Model #497)
Date: 1980 (February),
Theme: Space with Fighter Pilot themed elements
Game Type: Pinball
MPU: Williams System 6a (M6802)
Design: Steve Ritchie
Art: Constantino Mitchell
Software: Eugene Jarvis
Sound: Eugene Jarvis
Mechanics: John Jung
Notes: Left kickback. Lane Change. Three ball Multiball. Two Flippers.

Space Shuttle (Williams, Model #535)
Date: 1984 (December)
Theme: Space, NASA Space Shuttle
Game Type: Pinball
MPU: System 9. 7,000 game units made.
Concept: Joe Kaminkow
Design: Barry Oursler, Joe Kaminkow
Art: Mark Sprenger
Software: Larry DeMar
Sound: Eugene Jarvis, Bill Parod
Notes: Playfield Toy (a Tilting Plastic Shuttle). Lane Change. Two and Three ball Multiball.

High Speed (Williams, Model #541)
Date: 1986 (January)
Theme: Driving, being chased by Cops
Game Type: Pinball
MPU: This was first System 11 game
Concept: Steve Ritchie
Design: Steve Ritchie
Art: Mark Sprenger, Python Anghelo
Music: Steve Ritchie, Bill Parod
Software: Larry DeMar
Sound: Eugene Jarvis, Bill Parod, Larry DeMar
Notes: Topper rotating beacon (Red). First replay precentaging. First Multiball Jackpot (carry-over to next game). First Williams pinball game to use alpha-numeric displays. First diverter in a pinball.

F-14 Tomcat (Williams, Model #554)
Date: 1987 (March)
Theme: Fighter Pilot
MPU: System 11a
Concept: Steve Ritchie
Design: Steve Ritchie
Music: Steve Ritchie, Chris Granner
Sound: Bill Parod, Chris Granner
Software: Eugene Jarvis, Ed Boon
Notes: Topper has 3 rotating beacons (Red,White & Blue). Four ball Multiball.