INTERVIEW WITH EUGENE JARVIS

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

GAMOGRAPHY

1976 The Atarians Atari Pinball
1977 Time 2000 Atari Pinball
1977 Airborne Avenger Atari Pinball
1978 Space Riders Atari Pinball
1979 Superman Atari Pinball
1980 Firepower Williams Pinball
1980 Defender Williams Pinball
1981 Stargate Williams Videogame
1982 Robotron 2084 Williams Videogame
1983 Blaster Williams Videogame
1984 Space Shuttle Williams Pinball
1986 High Speed Williams Pinball
1987 F-14 Tomcat Williams Pinball

1980 NARC Williams Videogame
1990 Smash TV Williams Videogame
1990 High Impact Football Williams Videogame
1991 Strikeforce Midway Videogame
1991 Super High Impact Midway Videogame
1992 Total Carnage Midway Videogame
1996 Cruis’n USA Midway Videogame
1996 Cruis’n World Midway Videogame
1999 Cruis’n Exotica Midway Videogame
2000 Target: Terror Raw Thrills Videogame
2004 The Fast and the Furious Raw Thrills Videogame
2006 TFATF: Superbikes Raw Thrills Videogame

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?

I was a pinball player and computer science student at Berkeley, California in the 1970s. 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 6600 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.

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

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 microprocessor 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 horizons 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 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.

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.


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 might 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. Williams had a completely different system than Atari and we did not use a hardware synth as virtually all other game companies used, but rather a dedicated 1 Mhz 6800 microprocessor tied to a 8-bit DAC. Randy Pfeiffer pioneered this design and showed its power in the Steve Ritchie 1976 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 today’s 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 sound and data. It fit 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 a 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 fail-safe 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:** 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 alphanumerical animation (M-A-G-N-A-S-A-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 it “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 Glarner of Pinbot fame did an virtuosos 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 knew! I just love how the theme worked out so well, as the balls became fighter planes; they launched from the fighter deck, 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)

**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 alphanumerical animation (M-A-G-N-A-S-A-A-V-E and other effects on BK2K, for example) and finally whole shows and mini videogames played on the DMD?

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**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 achievement is the game itself. It is in 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!!!!!
### 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:** First Williams pinball game to use alpha-numeric displays, first diverter in a pinball.

### Space Shuttle (Williams, Model #535)
- **Date:** 1984 (December)
- **Theme:** 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
- **Game Type:** Pinball
- **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.

### 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
- **Sound:** 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)
- **Artwork:** Gjalt Vanderwyk, George Opperman
- **Software:** Eugene Jarvis
- **Sound:** Eugene Jarvis
- **Notes:** License tie in with DC Comics. Custom Sound Chip. Two flippers.