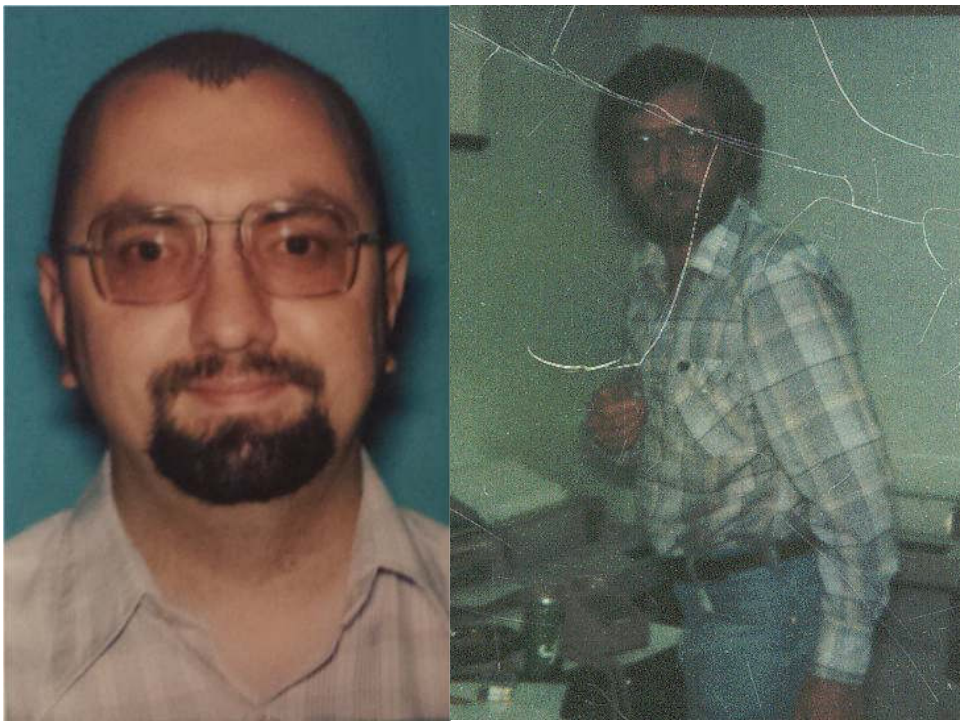
https://forums.atariage.com/topic/324889-technology-associates-and-the-story-of-intellivision-bump-%E2%80%98n%E2%80%99-jump/

You may be aware from updates to the Intellivision development history that I've been in contact with Joe Jacobs and Dennis Clark for a while. They have provided some background to the creation of their PlayCable development system and the subsequent work on Bump 'N' Jump. This posting details the story from Joe and Dennis' perspective and I'd like to thank them for helping me to put it together, and allowing it to be shared.



Joe Jacobs & Dennis Clark Circa 1980

Joe Jacobs and Dennis Clark are engineers who worked for Jerrold, the cable television division of General Instrument and manufacturers of PlayCable. Dennis joined Jerrold in the summer of 1978 working in Hatboro PA. Back then, in the early days of PlayCable development, Jerrold anticipated that, like Mattel, it would write games for the Intellivision to be distributed over PlayCable. In part, Dennis was recruited to go into arcades and scout for titles suitable for conversion. As it turned out Jerrold never wrote a game for the PlayCable, and Dennis did not make it to an arcade on company time. Instead, he worked in the Software Department writing firmware for cable boxes and PDP-11 software for Jerrold's cable head-end infrastructure. Development of the PlayCable hardware was well advanced by the first half of 1979, and over the summer Dennis worked to develop the firmware for the PlayCable adapter. He was also responsible for the music tracker used by the PlayCable menu program, and he arranged the version of The Entertainer that can be heard playing on the splash screen of the menu.

In early 1981 Joe Jacobs left Siemens, where he worked on automated test equipment. He was hired by Jerrold to work in their Head-End Division as a Project Engineer to develop hardware and software associated with the distribution of cable services. This equipment was used by cable companies to distribute and control their subscribers' access to channels. The systems that Joe worked on communicated with the converter boxes installed in customers' homes that Dennis helped to develop. Whereas Dennis is primarily a software specialist, Joe is more of a hybrid engineer, his focus is on hardware development, but he also writes software. Although Joe and Dennis looked after different aspects of Jerrold's products, they worked in close proximity to each other, and became good friends. Dennis recalls how Joe nicknamed him *"Grumpy"* because he always had a determined look on his face. Joe explained that "*In the early 1980's, Jerrold was still a small to mid-sized company and most of Jerrold's engineering was in one building"*. Dennis says that, under the management of Charles Dages, Jerrold's engineering department was very supportive of engineers' creativity and fostered collaboration.

It should be noted that when Mattel partnered with Jerrold to develop the PlayCable the two companies had a symbiotic relationship. Jerrold brought hardware knowledge specific to the cable industry and Mattel supplied access to the secret sauce for the Intellivision. This included the APh assembler and linker, and details of the EXEC and how to use it. Joe describes a *"HUGE listing called the Mattel 'EXEC'. This listing was an assembler list file generated when Mattel compiled the library routines that went into each and every Mattel Intellivision main unit. It was dot-matrix printed, on that wide paper with the holes at each end and was about two-inches thick. It described each and every routine available to the game developer, calling conventions, parameter passing, object creation and interaction, etc".* Dennis noted that the interrupt driven model of the Mattel EXEC was unusual for the time and something he thinks was very innovative. Although General Instrument could provide Jerrold with information about the Gimini chipset on which the Intellivision is built, it needed these Master Component specific resources to write software for PlayCable. Remember that Jerrold had to write the firmware ROM in the PlayCable adapter, the menu program used by customers to select games, and potentially original Intellivision titles. Therefore, Jerrold, like APh, was one of a small number of trusted partners, and Jerrold engineers like Joe and Dennis had an inside track on writing software for the Master Component. Interestingly, Dennis recalls that during the development of the PlayCable he visited APh in Pasadena to learn more about the Intellivision, a trip that led to him meeting Glen Hightower and the Intellivision developers.

It seems that at some point in late 1979, one of Dennis' colleagues, possibly Joe Rocci, realised that the head-end infrastructure could be used to create backups of Intellivision games that could be played at home. PlayCable games were transmitted from dedicated microprocessor controlled cards, housed in a PDP-11 minicomputer. These same cards were also used by cable company head-end systems to communicate with consumers' cable boxes. A side effect of the encoding scheme used to transmit PlayCable titles was that the game data could be recorded directly off the transmission cards onto a regular audio cassette. The image below shows one such a DCX11A (Dual-Channel Xmitter) card connected to an audio adapter that was used to record Intellivision games.

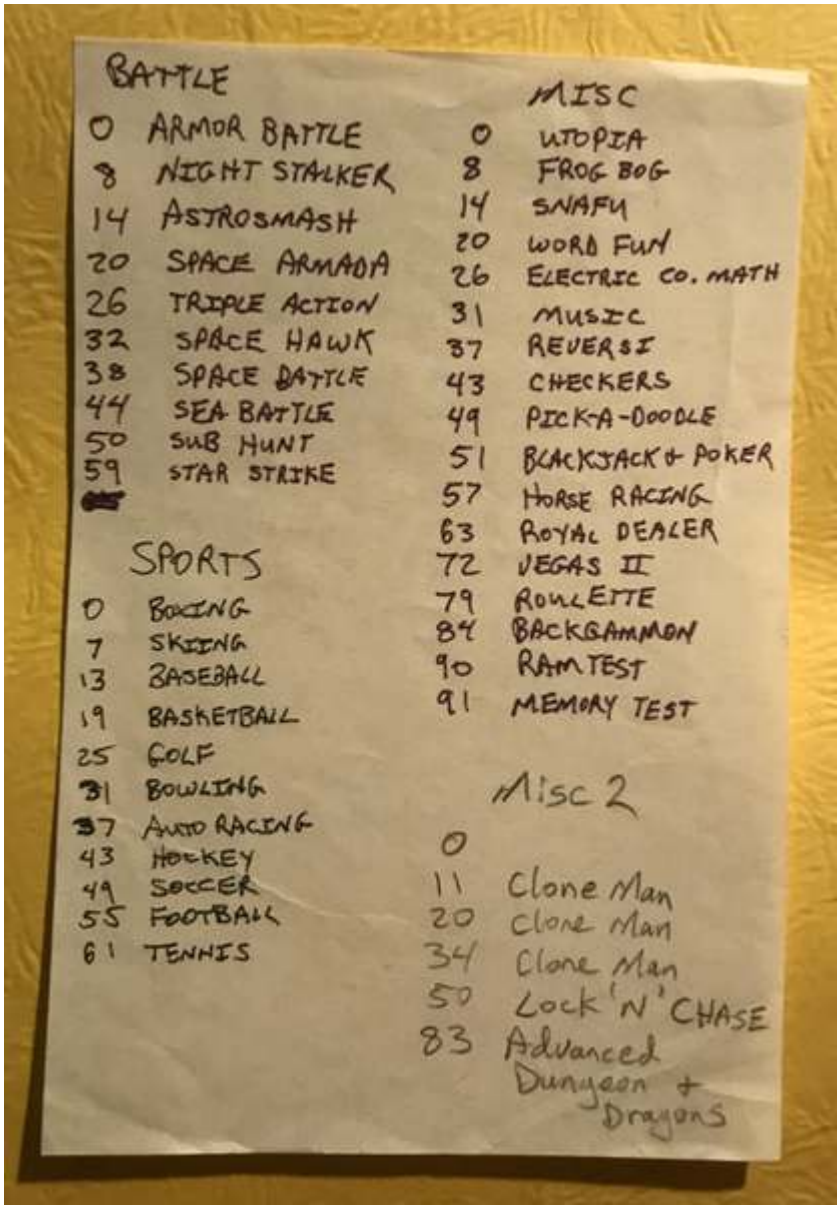
DCX-11A DataChannel Transmission Card with Audio Adapter

Jerrold engineers could load games into the transmission card, connect the digital output to a tape machine using the adapter box and record the resulting stream. At home, they could then connect a regular audio cassette tape machine to a hacked PlayCable adapter and play the recorded game directly into the PlayCable's memory. To make this work required some changes to the PlayCable adapter firmware, and for the digital board within the adapter to be connected to an audio input, rather than the normal cable receiver. These hacked PlayCable adapters were based on the earlier, limited-production Jerrold model which, unlike the later PlayCable branded units, had their digital sub-system implemented using standard off-the-shelf components. This made them much more hackable by exposing their inner secrets to those in the know, or with access to oscilloscopes and datasheets (see Sections 8.1 and 8.2 of the PlayCable Technical Summary for more information). Jerrold's engineers christened these audio backups "PlayTape". This innovation gave unrestricted access to the entire Intellivision PlayCable games library and was shared amongst some of the members of the engineering department. As Joe says, *"all of us engineers had a modified PlayCable setup so we could play Intellivision at home. Remember, at the time, Intellivision was the 'cat's meow' of video games, handily beating the Atari 2600; Colecovision had not yet come on the scene".* Dennis believes that the management of Jerrold's engineering department were probably aware of what their engineers were up to, but turned a blind eye, not seeing any harm in it.

Title Screens for the Standard PlayCable (left) and Joe's PlayTape (right)

On joining Jerrold in 1981, Joe quickly discovered what was going on and got involved, contributing to the modified firmware that ran on the PlayTape adapters. Before joining Jerrold, Joe had put together a small PDP-11/03 "Frankenstein" system of his own at home. This was compatible with the computers that were used to develop Jerrold's cable head-end software and write Intellivision games. Through the summer of 1981 Dennis continued to tinker with Intellivision

development, stripping sounds from Mattel games and building a sound board application to play them back. Joe's interest in video games led him to start reverse-engineering the Arcadia Supercharger following its release for the Atari 2600. He figured out a way to read some of his Atari game cartridges and transfer them to the Supercharger replicating the "game-backups-on-tape" principle behind PlayTape.



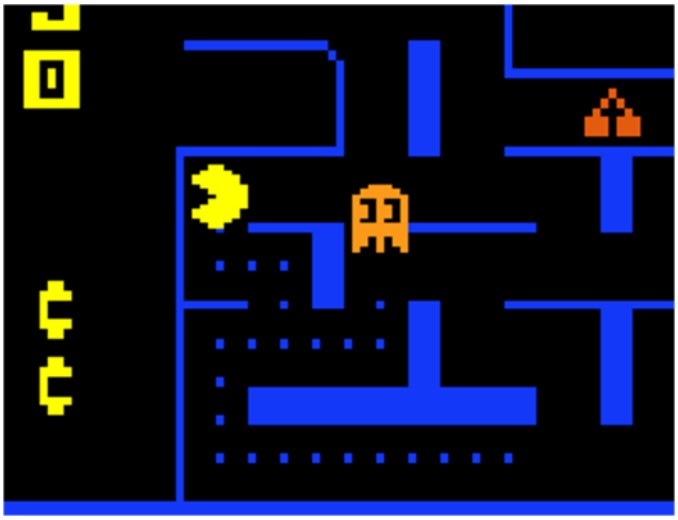
Catalogue of PlayTape Titles

Through the fall of 1981 the library of PlayTape games was extended as new titles were released for the Intellivision, the pair also wrote diagnostic programs, and started to investigate the inner workings of the Intellivision's EXEC. Joe realised that it would be possible to use a specially-modified PlayCable adapter, along with his Frankenstein PDP-11, and the tools he had access to at Jerrold, to develop rudimentary Intellivision games. Inspired, Joe suggested to Dennis that they *"try and write a game for the Intellivision"*. Dennis was up for the challenge and explained the methods Jerrold used for Intellivision development. Joe recalls that the process was pretty simplistic. *"It wasn't a whole lot, in my mind, it was basically EPROM burn and crash and burn and crash and... development"*.

By this point Dennis also had a PDP-11 at home, put together from spare Jerrold equipment. Building such home systems was supported by Jerrold, as it allowed engineers to continue to work on company projects in their own time. In the meantime, Joe had started to think about how to improve the development tools, *"I was, and still am, an in-circuit emulator kind of guy and prefer to do my software debugging in that environment if possible"*. According to Dennis, testing was done using *"something like ROM simulators to load the code from the LSI-11 to a modified Playcable type adapter"*. This allowed test code to be uploaded from their development machines directly to the PlayCable, bypassing the need to

use a broadcast card and audio cassettes. Joe says that *"the whole concept was loosely modelled on the then-popular Motorola ExORciser development environment"*.

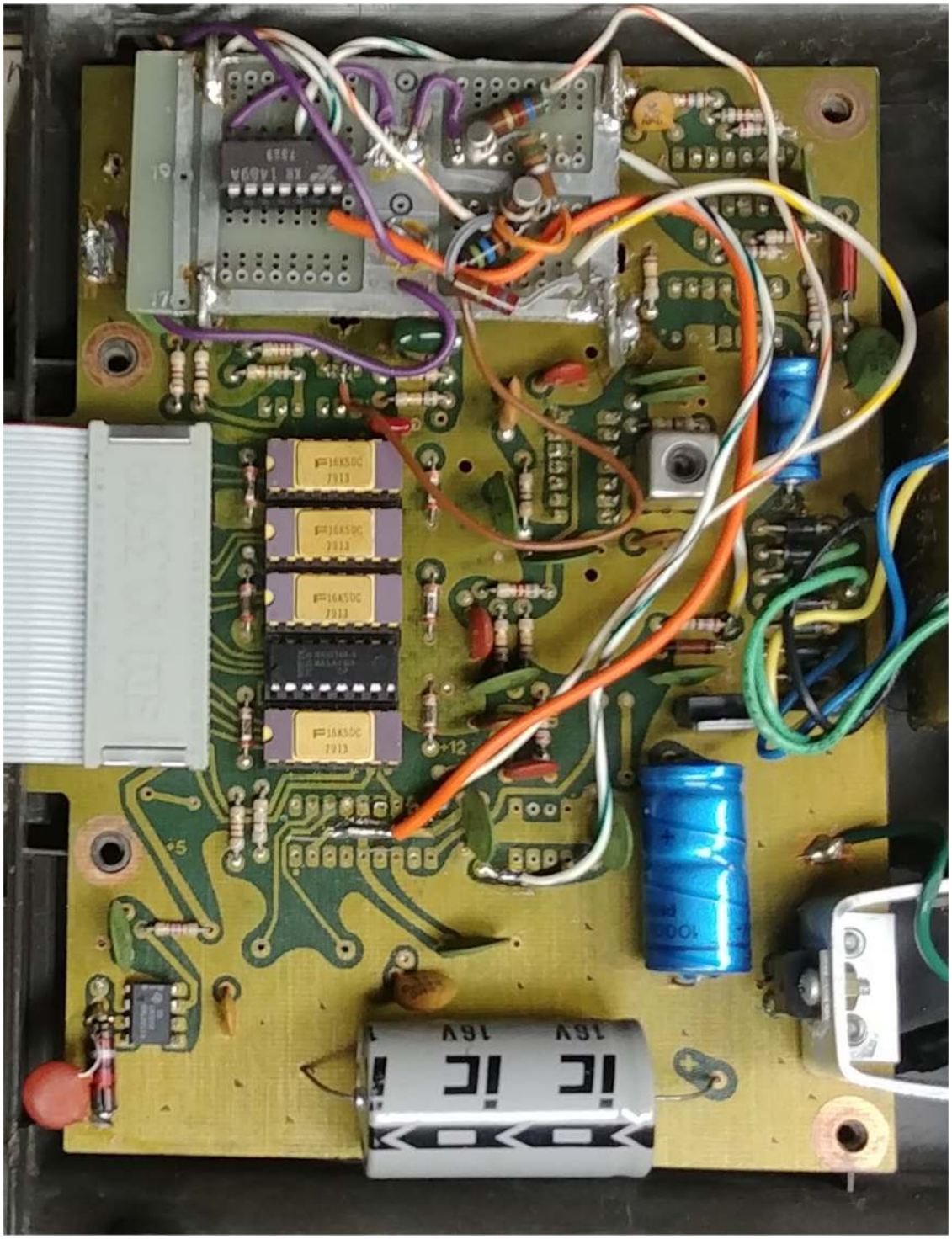
In the spring of 1982 Dennis and Joe concluded that they needed a demonstration to showcase their maturing Intellivision development capabilities and grab the attention of Mattel. They tossed some ideas back and forth and settled on writing Clone-Man, a homage to PAC-MAN. At the time PAC-MAN had just been released on the Atari 2600 and was at the forefront of public consciousness. Unfortunately, this next step in the journey coincided with Dennis suffering a back injury. Despite this, Joe and Dennis pressed ahead with Clone-man over the next two or three months whilst Dennis was off work recovering from his back injury. This led to Clone-Man initially being credited to "Bedside Productions". Within the team, Dennis' focus was on core software, with Joe sorting out the hardware necessary for their development systems and providing some additional utilities. Dennis says that he saw porting PAC-MAN as *"just a challenge to see how to copy an arcade video game onto Intellivision"*.



Clone-Man - a Glimpse of Dennis and Joe's homage to PAC-MAN

The resulting "Demonstration Program" was a pretty comprehensive recreation of the game, with a landscape version of the original maze, power pellets, bonus fruit, and sound effects. However, the algorithms that drive the movement of Blinky, Pinky, Inky and Clyde were not replicated and there are no intermissions. Overall, the game is clearly superior to the Atari 2600 version, but is not as polished as the Atarisoft version for the Intellivision, for example the sound effects are not replicated as accurately. As Joe says, Clone-Man *"came out pretty good. Not good enough for commercial appeal, but good enough"*. Dennis' opinion is that *"it would have been hard to tell it from Pac Man"*, which is probably stretching things. However, with its more accurate maze, it clearly attempts to be more faithful to the arcade original than either the Atari 2600 or official Intellivision ports.

Throughout this period, Joe and Dennis continued to enhance their PlayCable test systems. The modified adapters were linked to their PDP-11 computers using an RS-232 serial connection, and ran enhanced firmware containing a debugger called CYBER. The pictures below show the results of Joe and Dennis' alterations (see Section 8.3 of the PlayCable Technical Summary for more details).

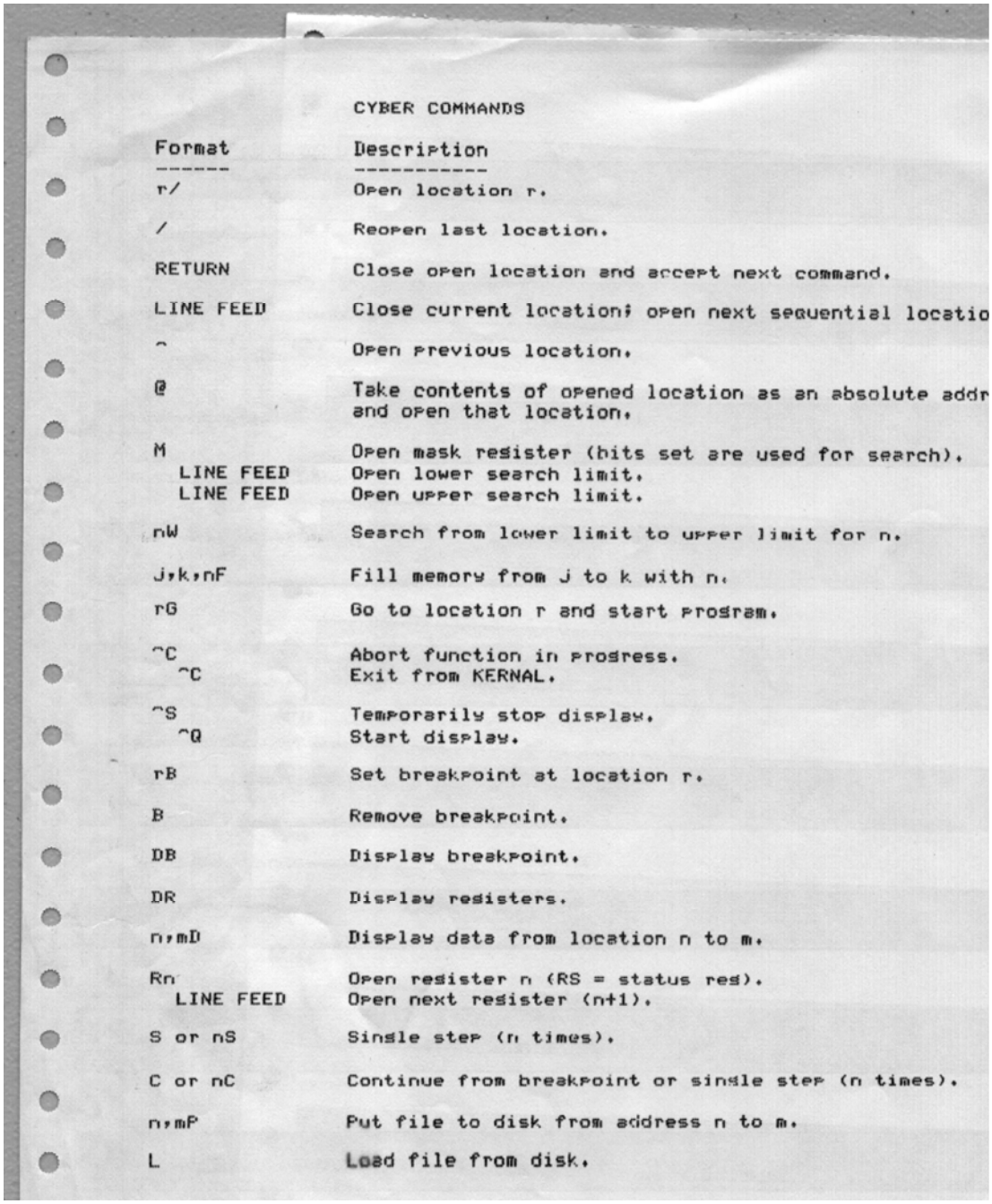


Joe and Dennis' Development Kit PlayCable Receiver Board

Joe and Dennis' Development Kit PlayCable Digital Board

In addition to modifying the PlayCable adapters to support RS-232 communication, Joe added what he calls a *"vector"* board to their development Intellivision Master Components. These enabled breakpoint and single stepping features to be added to the CYBER debugger being developed by Dennis. A video showing CYBER being used to debug an Intellivision program can be seen here:

The modifications made to the PlayCables were pretty extensive, and together with Dennis' CYBER debugger, they led to the early MAGUS-like ROM emulator turning into a system that had similar features to Mattel's Blue Whale test harness. This can be seen in the following list of CYBER commands:



CYBER COMMANDS

Format	Description
r/	Open location r.
/	Reopen last location.
RETURN	Close open location and accept next command.
LINE FEED	Close current location; open next sequential locatio
^	Open previous location.
@	Take contents of opened location as an absolute addr and open that location.
M	Open mask register (bits set are used for search).
LINE FEED	Open lower search limit.
LINE FEED	Open upper search limit.
nW	Search from lower limit to upper limit for n.
j,k,nF	Fill memory from j to k with n.
rG	Go to location r and start program.
^C	Abort function in progress.
^C	Exit from KERNAL.
^S	Temporarily stop display.
^Q	Start display.
rB	Set breakpoint at location r.
B	Remove breakpoint.
DB	Display breakpoint.
DR	Display registers.
n,mD	Display data from location n to m.
Rn	Open register n (RS = status reg).
LINE FEED	Open next register (n+1).
S or nS	Single step (n times).
C or nC	Continue from breakpoint or single step (n times).
n,mP	Put file to disk from address n to m.
L	Load file from disk.

CYBER Debugger Command Crib Sheet

Once Clone-Man was complete, Joe says he *"did some checking with Jerrold management about our intentions of writing something for Mattel; they didn't have a problem so I went for it"*. He used a Betamax video camcorder to record Clone-Man running on the Intellivision and sent the tape to Don Daglow at Mattel. At this point Joe says that *"evidently, the crap hit the fan at Mattel"*. Joe doesn't really remember any fallout at Jerrold over Clone-Man, but the Mattel people were clearly *"spinning in their seats"*. Given Mattel's paranoia over industrial secrecy, this was perhaps inevitable. Many phone conferences ensued over the next couple of months as Joe negotiated a deal with Mattel to write a game. This led to an agreement in December of 1982 that Technology Associates, the fledgling computer consulting company founded by Joe in 1981, would write a port of Bump N Jump for the Intellivision under contract to Mattel. Effectively, Technology Associates became a second-party developer for Intellivision, like APh. As might be expected, Mattel seems to have been concerned that Joe and Dennis could take their skills and knowledge to a competitor. However, Joe and Dennis are clear that this was never an option for them and, despite what is reported elsewhere, they did *not* threaten to do so. In fact, Jerrold was aware that Joe and Dennis had approached Mattel, and seems to have been supportive of their entrepreneurial streak, as they both continued in their day jobs. The reasons for Jerrold's lack of concern over their game-writing endeavours are unclear, although Joe explains it like this, *"We did not work on BNJ during our work hours at Jerrold for obvious reasons. Jerrold was aware of the situation and left us to it. At the time, we were pretty valuable employees... Besides, there was absolutely no negative karma, letting us do our own thing at the time. A benefit of working for a smaller*

company”. Regardless, like Clone-Man before, the Bump N Jump project was to be an extra-curricular activity for Joe and Dennis that occupied their evenings and weekends. What would have happened if a deal had not been struck? According to Joe and Dennis, they would have continued working for Jerrold at their regular day-jobs, and would have explored the Intellivision on their own time just for fun.

Having landed the contract to write Bump N Jump, and with the dust settling, Technology Associates purchased two new PDP-11 systems from Sigma Information Systems, complete with 8” floppy disks and enormous 20MB hard drives. These machines would be used to do the bulk of the subsequent Bump N Jump development. Up to this point, Joe and Dennis only had a single PlayCable development system to test Clone-Man. Joe took the opportunity to rectify this by building a second test harness to use while creating Bump N Jump, and the pair set to it.

In all, development of Bump N Jump took around six months of intensive work in the evenings and weekends. Joe suggests that *“Dennis was, no question, the brains behind the code. While he worked on game play such as object generation, object interaction, scoring, etc. I was responsible for the entire background”*. Dennis agrees, explaining that *“Joe did the background and track work”,* effectively being responsible for the accurate reproduction of the levels. To help with development, Mattel shipped an arcade version of Burnin’ Rubber (the international variant of Bump ‘N’ Jump) to Dennis' house. Once installed in the basement, Dennis' girlfriend's son played the game for hours and became an expert at it. Joe used his camcorder to record the teenager’s games for use in development. By watching the recordings back, over and over, ad nauseum, Joe was able to transcribe the levels of the arcade game using a level designer written by Dennis. Joe says, *“The background of Bump ‘N’ Jump is basically a gigantic table of ‘cards’, with the presentation of those cards handled by Dennis’ level designer code”*. As a consequence, the Intellivision port has a faithful reproduction of the playfield of the arcade version, including the track layout, bridges and other obstacles. Meanwhile, in addition to the core game mechanic, Dennis wrote more tools, including a music generator and an animation designer to support development.

As Bump N Jump took shape it became clear that the 8K of RAM within their PlayCables was not going to be enough to hold the full game. Sadly, the limits of their homebrew development kit had been exceeded. So, Joe *“contacted Mattel to ask what was available to get past the 8K limit, and their answer was a board called the 16K Megas board"*. Mattel sent a couple of Megas (aka MAGUS) test harnesses for end-to-end play testing and Joe sorted out the hardware necessary to interface them to their PDP-11s. This he did by customising a Heathkit parallel interface board. Joe explains that during use *“you had to tell the Megas board to 'freeze' the CPU from accessing the Megas ram, load the RAM, un-freeze the CPU and then tell the CPU where to start executing. Basically, it was a RAM-based burn and crash idea, but instead of burning an eprom or rom, you 'burned' the Megas RAM and it was pretty quick. A lot quicker than burning chips. The Megas wasn't really for troubleshooting/debugging but more an end-to-end play/test of the game you were working on”*.

As was mentioned by Keith Robinson at Classic Game Fest in 2016, David Warhol acted as the liaison between Mattel and Technology Associates. Unfortunately, the relationship between the two organisations was not easy, as Joe observed, *“I think the Mattel developers were definitely leery of us and certainly didn't voluntarily share anything on their own. If we had a particular question [that] needed answering they did answer but only the exact answer, nothing more, nothing less. We were still 'outsiders'”*. Mattel’s attempts to limit the flow of information to Technology Associates can be seen as part of their ongoing attempts to hold their cards close and prevent third parties developing games for the Intellivision.

Joe and Dennis finished the core game of Bump N Jump at the end of May 1983 and shipped the source code containing two levels to Mattel HQ in Hawthorne. Once there, it entered the Intellivision QA process. A BSR review meeting in the first week of June highlighted that game play tuning was required. The most significant points raised were that the game required a greater sense of speed, with the enemy cars needing to be easier to bump and kill, but also requiring more personality and aggression to increase the intensity of the game. A number of developers requested the inclusion of an engine sound, to provide auditory feedback of the player’s speed. It was at this point that Mattel decided a change to the title screen was also required. The original received mixed reviews, with some confusion about whether it depicted a road or a mountain. Regardless, it was felt to be too similar to the introduction of Buzz Bombers and needed an update. The final animated titles were developed by Daisy Nguyen and seem to have been added sometime in early July. As always, there were also some bugs found that were subsequently fixed. Although Joe and Dennis don’t recall Mattel requesting much work after the code was shipped, a message from David Warhol suggests that the updates were split between Mattel and Technology Associates, with Mattel looking after graphical tweaks and Daisy’s title screen, while Joe

and Dennis focused on game play tuning. It's clear that not all Mattel's suggestions were included, for example, music wasn't added to Daisy's title screen, and the requested engine sound isn't present in the released version. The final game with its full set of levels was accepted for production by Dale Lynn and Traci Glauser on August 1st 1983 as can be seen in the QA report below.

INTELLIVISION
AQUARIUS PROGRAM
TRACKING DOCUMENT

PROGRAM NAME: Bump'n Jump
PRODUCT #: 4688
PROGRAMMER: JA

CODE RELEASE AND DATE	PROM DATE	PROM CHECKSUMS	QUALITY ASSURANCE RECEIPT DATE	QUALITY ASSURANCE RECEIVED BY	QUALITY ASSURANCE APPROV	QUALITY ASSURANCE REJECT	QUALITY ASSURANCE DATE	COMMENTS
PRE CODE RELEASE 6/17/83	6/17/83	12K no checksums	6/17/83	TRACI GLAUSER		X	6/17/83	New title screen to come
REVISION 1 7/6/83	7/6/83	16K no checksums	7/6/83	TRACI GLAUSER		X	7/18/83	Bonus scoring incorrect Does not work then lucky.
REVISION 2 7/22/83	7/22/83	no checksums 16K	7/22/83	TRACI GLAUSER		X	7/27/83	
REVISION 3 7/27/83	7/27/83	16K no checksums	7/27/83	TRACI GLAUSER		X	7/28/83	
REVISION 4 7/28/83	7/28/83	16K no checksums	7/28/83	Dale Lynn		X	7/29/83	
REVISION 5 7/29/83	7/29/83	16K no checksums	7/29/83	Dale Lynn	X		8/1/83	
FINAL CODE RELEASE								

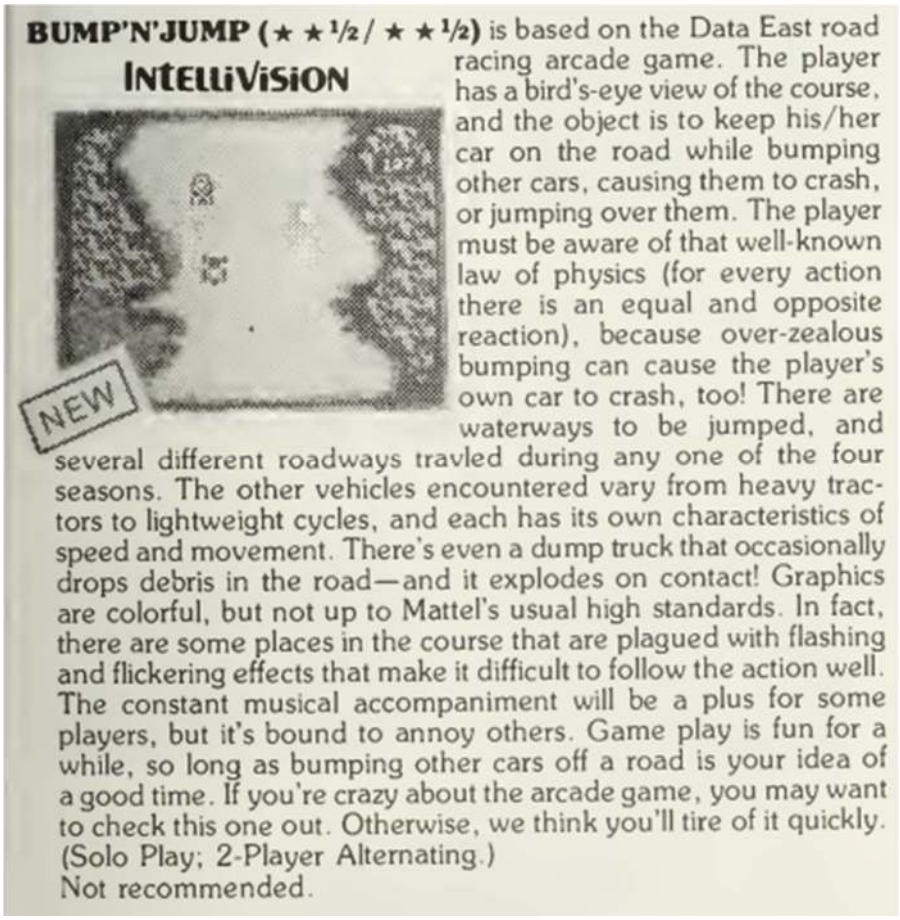
TO SOFTWARE SUPPORT ON: _____ RECEIVED BY: _____

Mattel Bump N Jump QA Record

At around this time it normally took Mattel about three months to get from acceptance of the final code to a game hitting the stores. Roughly two months of this time was ROM production, with the last month typically being consumed with finalising printed materials, packaging the game and distribution. The advert below for Bump N Jump was run in the October and November issues of games magazines across the US, and according to The Video Game Update, the title was one of the last games Mattel released when it hit store shelves in November 1983.

Bump N Jump Print Advertisement

Joe and Dennis are rightly proud of Bump N Jump and they feel that the title really pushed the capabilities of the hardware. The game play is very similar to the arcade, with the original levels and background music both faithfully reproduced. Unfortunately, interest in the Intellivision dwindled rapidly with the closure of Mattel Electronics at the start of 1984, and there seems to be very little about Bump N Jump in the press after its release. The Video Game Update did review Bump N Jump in their January 1984 issue, giving the title two and a half out of four stars for both graphics and gameplay, rating it as fair to good, but questioning the game's depth, and therefore not recommending it.



BUMP'N'JUMP (★ ★ ½ / ★ ★ ½) is based on the Data East road racing arcade game. The player has a bird's-eye view of the course, and the object is to keep his/her car on the road while bumping other cars, causing them to crash, or jumping over them. The player must be aware of that well-known law of physics (for every action there is an equal and opposite reaction), because over-zealous bumping can cause the player's own car to crash, too! There are waterways to be jumped, and several different roadways traveled during any one of the four seasons. The other vehicles encountered vary from heavy tractors to lightweight cycles, and each has its own characteristics of speed and movement. There's even a dump truck that occasionally drops debris in the road—and it explodes on contact! Graphics are colorful, but not up to Mattel's usual high standards. In fact, there are some places in the course that are plagued with flashing and flickering effects that make it difficult to follow the action well. The constant musical accompaniment will be a plus for some players, but it's bound to annoy others. Game play is fun for a while, so long as bumping other cars off a road is your idea of a good time. If you're crazy about the arcade game, you may want to check this one out. Otherwise, we think you'll tire of it quickly. (Solo Play; 2-Player Alternating.)
Not recommended.

Video Game Update Bump N Jump Review

However, history has been rather kinder to Bump N Jump, the title is now consistently rated amongst the Intellivision's best games. This includes the current generation of Intellivision gamers placing it in the top 10 Intellivision titles in 2014, and the top 15 games in 2019. Reviewers such as The Intellivision Library, Intv Funhouse and Video Game Critic all rate the game highly, noting the quality of both graphics and sound, and the accuracy of the conversion. Overwhelmingly, the prevailing wisdom is that Bump N Jump deserves a place in your Intellivision collection.

In late June 1983 Mattel Electronics announced the first round of redundancies that would mark the start of a death spiral for the division. Unsurprisingly given the timing of the completion of Bump N Jump development, Joe and Dennis didn't receive offers of additional Intellivision work. With hindsight, the decision to continue to work for Jerrold whilst developing Bump N Jump on their own-time can be seen as an excellent one! Later, at the end of September David Warhol wrote to Joe and Dennis explaining the situation, and expressing the hope that more projects might be on the horizon with Mattel's new focus on software; unfortunately, this future never materialised. Although they were initially unaware of the turmoil at Mattel, it was clear to both Joe and Dennis that they would always be considered outsiders at Hawthorne. In addition, Dennis explained that he enjoyed his work at Jerrold, and whilst writing Bump N Jump was profitable as a side-line, the money they made writing it wasn't good enough to tempt the pair into giving up their day jobs. They also decided against pursuing opportunities with other games companies. Instead, they continued working for Jerrold and went back to just hacking for fun. Having grown tired of his lengthy commute to Hatboro, Joe left Jerrold in 1984 for a new role working for Omnidata (later Singer-Link Simulation) on power plant simulators, used to train control room engineers. However, Dennis continued with Jerrold, rising through the ranks to become Director of Project Management before retiring in the mid 2000s.

So there we go, the story of the development of Bump N Jump and the mythical PlayCable development system from the perspective of Joe and Dennis. Incredibly, their whole Intellivision adventure lasted less than 30 months. It would be great to get the recollections of Mattel people like Don Daglow and David Warhol, and the management at Jerrold to complete the picture. Hopefully one day.

One last thing before I go… A little birdy tells me that there is an Easter egg buried in Bump ‘N’ Jump that has gone undiscovered since the game’s release. Can the players and developers of the Intellivision Brotherhood find it? The challenge has been issued, just for kicks.

Once again, thanks to Joe and Dennis for giving their permission to share their story and for their help in putting it together.