

CoCo~123



Glenside Color Computer Club, Inc.
Volume 37, Number 4

Carpentersville, Illinois
Winter 2017

CoCo ~ 123 Memory Map

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Upcoming Events:
 The **27th** Annual "Last" Chicago CoCoFEST! **April 21-22, 2018**
 Regular meetings every 2nd Thursday @ Schaumburg Library.

G.C.C.C. OFFICERS

Here is the list of 2017 club officers and how to contact them. If you have questions about the association, call one of the officers for the answers.

POSITION	NAME	PHONE	PRIMARY FUNCTION
-----	-----	-----	-----
President	Tony Podraza	847-340-1801	The buck stops here...
Vice-President	Chris Hawks	815-943-4690	Meeting planning, etc.
Treasurer	Brian Goers	708-805-1888	Dues and Purchasing
Secretary	Rich Bair	847-835-1309	Records and Reporting
Director	Tony Podraza	847-340-1801	CoCoFEST! Organizer
Librarian	Brian Goers	708-805-1888	Special Events
Editor	John Mark Mobley	847-409-8604	Newsletter Production
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Tony Podraza



Chris Hawks



Rich Bair



Brian Goers



John Mark Mobley

CoCo~123 - A Glenside Publication Since 1985

CoCo~123 INFORMATION

CoCo~123 is the newsletter of the Glenside Color Computer Club. Your annual contribution of \$15.00 helps to keep our club going. Send your check to:

Brian Goers, Glenside Treasurer
3312 Miller Avenue
South Chicago Heights, IL 60411

Our treasury provides newsletters and good times with fellow CoCo users at our Annual "Last" Chicago CoCoFEST! and our Annual Glenside Picnic.

If you attend the Annual CoCoFEST! your annual contribution is covered for that year.

CoCo~123 CONTRIBUTIONS

If you have any suggestions for the newsletter or would like to submit an article, please contact the CoCo~123 Newsletter editor:

John Mark Mobley, Editor
4104 Wren Lane
Rolling Meadows, IL 60008
johnmarkmelanie@gmail.com

CONTRIBUTORS TO THIS ISSUE

Salvador Garcia	John Linville
Brian Goers	John Mark Mobley
Fred Hicks	Tony Podraza

G. C. C. MEETINGS

The Glenside Color Computer Club meets the second Thursday of each month at the Schaumburg Township District Library at 7:00 pm. If you need a map, see the following link:

<http://ncmedals.com/glenside/splmap.html>

A social get-together, which we lovingly call "The Meeting After", always follows the meeting at a nearby restaurant.

FROM THE PRESIDENT'S PLATEN

John Chasteen
by Tony Podraza

John Chasteen passed away. John was a former president of the Glenside Color Computer Club, Inc.



He was instrumental in opening many of our member's interests, back in the late 80's and early 90's, to the Chicago OS9 Club and spurring the transition, no, the addition of OS9 to those members' interests.

John Thomas Chasteen affectionately known to family members as Poppy, was born in Indianapolis, Indiana on June 17, 1928. He went

to the Lord in his sleep 7:15 am February 13th 2018 while living on Big Pine Key, Florida. Poppy preceded by his wife Phyllis (d. 2000) and his grandson Matthew Thomas Combs (d. 1990) is survived by his daughter Donna Combs and grandson Patrick Combs Jr, two great grandchildren Patrick the III and Kayleigh Combs, two brothers Paul Chasteen (twin) and James Chasteen and many nieces and nephews.

John moved to Florida 3 or 4 years ago, due to the climate. He has been missed and will continue to be so. In lieu of flowers please send donations to Search for Vision, 1011 S Waiola Ave, La Grange IL 60525.

On a brighter note, there are 30 exhibitors signed up for the CoCoFEST! Over 43 tables have been requested. You can get a preview of the attendees by visiting the club's webpage @ www.glensideccc.com. The software and hardware to be presented would boggle the minds of the 1980's novice. Back then, we were drooling over floppy drives, memory upgrades, remote keyboards, hard drives and monitors. At this year's FEST, we will still be drooling over these things in the form of solid state drives, laptops being used for file storage, wireless connections, NEW GAMES, OS9 developments to be discussed and a whole bunch more that were never imagined for the CoCo, even in the 90's.

There will be a new form of the Club database that you will be able to log into and update your own information. It is web-based, so you will be able to do that from anywhere that the web is available. It is password protected, so only you can update your own information. Our intentions are to have at least 5 stations at the registration table from which you can do this. (VAPORWARE ALERT) In fact, if, and only if, things go well, you should be able to pre-register and submit the entrance monies via PayPal or other major credit card by the time that you receive this by logging into the database and accessing the FEST! Registration Page. If the registration page is not yet operational by the time you read this, you can still update your own records by doing this:

```
TDYLTPWD.BAS
10 GOTO "www.tandylist.com"
20 click on "reset my password"
30 INPUT (your email address)
40 GOTO "your email" REM, external operation
45 REM (check your junk/spam folder if you do not see the
email from "do not respond@tandylist.com")
50 ELSE GOTO 10
RUN
```

Please do not register for the FEST! In this manner after April 15, as we need to tally the registrants that week. "It don't happen in the blink of an eye, folks".

If you cannot make the trip to the FEST! but would like to donate towards the expenses, you can do that via PayPal using the account brian7eg@gmail.com.

I have mentioned on the Club's Facebook page that there would be some pre-auction separation of the donated items. Please be judicious in your donations. This year, in addition to the NMBA, there will be a dedicated area for "FREE" stuff. Please use this area for your surplus items that you would like to pass on, but may not really be in actionable condition. Just give it some thought ahead of time.

I could stop here, but....

If you plan to attend the catered dinner at 6:00 pm Saturday evening for only \$20 per person (12 years and younger free) let us know how many. Here's the entire menu: Pulled Pork, Shredded Chicken, Beef Brisket, Pig Wings, Au Gratin Potatoes, Cole Slaw, Baked Beans, Garden Salad, Fresh Rolls, BBQ sauce, Gluten-Free Cheese and Veggie Lasagna, Lemonade, Tea, and Soft Drinks.

With only 30 or so days left, as of this typing, it is EXTREMELY important to know how many will be coming to dinner. We do not want to run out of food, and we do not want to over-buy. This is always a balancing act. If you have not already indicated as such, please send me an email @ tonypodraza@gmail.com. Thank you.

Here is a reminder for all exhibitors. If something leaves our table and will be transported out of the FEST!'s area, please be considerate enough to supply the new owner with a receipt. The Border patrol, State or Federal (we don't need no stinking badges), can get pretty testy, sometimes.
Till next time,
I bid you peace.

Tony Podraza, President
Glenside Color Computer Club

TREASURY NOTES

Our checking account balance as of Feb. 28, 2018 is \$7,146.99.

Brian Goers, Trea\$urer
Glenside Color Computer Club

THE EDITOR'S CLIPBOARD

We are looking for people to submit articles for the newsletter.

John Mark Mobley, Editor
Glenside Color Computer Club

The 27th Annual "Last" Chicago CoCoFEST! by John Mark Mobley

The event shall be Saturday & Sunday April 21-22, 2018. CoCoFEST! is a vintage computer festival featuring the TRS-80 Color Computer, Tandy Color

Computer, TRS-80 Micro Color Computer MC-10, and their clones. Other vintage computer systems are welcome. The event is in Lombard, Illinois in the lower level of the Heron Point Convention Center next to the Fairfield Inn.



Community Recognition

By: Salvador Garcia and John Mark Mobley

The Color Computer community is a dynamic and vibrant entity with people who go above and beyond to bring us new software, games, and hardware accessories. Some go loudly into the night providing news, talks and interviews to keep the community informed and motivated.

The Glenside Color Computer Clubs recognizes this and is proud to present a small and humble acknowledgement those who help make this a successful and motivated community.

The acknowledgement is a small trophy awarded to those who in some way have stood out through their achievements in excellence towards our community.

An online survey was conducted to select the categories and the winners. With the stipulation that you must be present at the CoCoFEST to win, these are the categories:

Glenside has purchased 8 trophies this year:

- Most Useful New Product
- Most Educational Project
- Most Entertaining New Product
- Most Helpful Mentor
- Continuing Achievements
- Most Effective Community Promoter
- Most Innovative New Product
- To Be Determined



Trophy

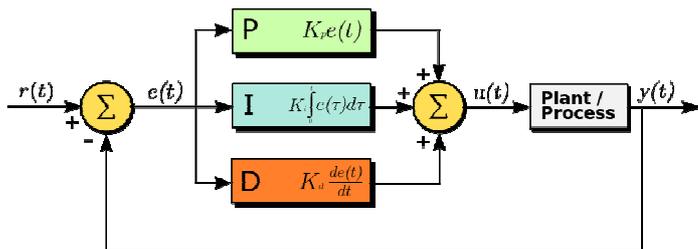
Proportional-Integral-Derivative (PID) Controllers and Artificial Intelligent (AI) Opponents

by John Mark Mobley

First I recommend the following link:

<http://www.wescottdesign.com/articles/pid/pidWithoutAPhd.pdf>

Video: <https://www.youtube.com/watch?v=fusr9eTceEo>



PID Controller

Picture obtained from Wikipedia

This link includes the source code for a PID controller. I took this source code and converted it from floating point math to integer math in C for a project I was doing at work. I added acceleration and deceleration. I added max and min limit for the integral term. I can have two integral gains – if adding, use the acceleration-integral-gain, and if subtracting, use the deceleration-integral-gain. I can also zero out the accumulator used in the integral term, if excessive overshoot is detected. I also added a feed-forward term.

A PID can be used for situations where you need to hunt for the answer.

The answer has to be somewhat linear. That is increasing input increases the answer or result; and decreasing the input lowers the answer or result. I think it is kind of like a phase locked loop (PLL).

It's like when you are driving. You know you want to go 60 MPH but you don't know in advance how much to press down on the accelerator pedal. So you press it down an inch to see what happens. Then you look at the speedometer and adjust your foot until the speed is close enough to what you want.

I have not tried this, but I think you could use PID as an AI opponent in a game of pong. A car racing simulator will allow you to race against other AI opponents. How is the AI car speed controlled? (PID) When should the AI car change gears? (fuzzy logic or expert system) How is the AI car steering accomplished? (PID) Should the AI car pass another car? (logic). Also as the game or simulation progresses to a higher level, you may want to apply better tuning to the AI logic. Should the AI aim for your previous position from 100ms ago, your current position, or at a projected position based on extrapolation? Should the AI use a random term to improve its odds?

You can have one PID algorithm (class) that works on multiple variable data sets like gains and such (instances of a class). Each AI opponent can have several modes/states of operation (advance, hold your ground, and retreat) as well as several attack formations. And you can also have more than one AI opponent like in PAC-MAN, Dig Dug, and XMAS Rush. So you could have one set of code with an array of settings like intergralGain[level][mode][ghost], where mode is normal or blue, and the ghost is Blinky, Pinky, Inky, or Clyde. So you can have a state machine that is made up of different control systems. And as the state changes, the AI behavior changes according to the new rules of the control system that is selected. You may be competing against a PID one moment and an expert system in the next moment. If the Pong's AI opponent is ahead by 5 points, then it can play a sloppier game.

With a PID motor speed control system, a brownout may occur, and the integral term may increase to compensate for the brownout. But when the brownout is over, the system

may experience an overshoot where the RPM reaches a high value. The software can detect this and zero the accumulator that makes up the integral term. Ex: If error is less than negative 70 RPM then $PID \rightarrow integralState$ equals zero.

I use acceleration to control the goal position/speed/temperature setting. So the desired position is fed into the acceleration engine, and the goal position comes out. The goal position is used to drive everything else. The goal position will equal the desired position when the acceleration time is up. There may be another way to control acceleration. Rather than (or in addition to) accelerating the goal position, you could possibly control the acceleration of the actual position. Idea: If the actual position is accelerating too much, then don't increase the integral term accumulator for this time slice/sample period. Also you can somewhat control acceleration by decreasing the integral gain.

You should also add jerk control, which is controlling the change in acceleration. If you have ever ridden in an elevator and felt like the floor dropped from underneath you, then you know what jerk is. If jerk is controlled properly, then you will not feel that sensation. Mechanical parts can sometimes be made to last longer by controlling jerk.

You can also have a PID control loop inside of another PID control loop – a nested loop.

Tuning the PID takes some practice. There is no one right way to tune a PID control system.

Step 1) Create a step response test and run it for the steps below.

Step 2) Set the acceleration and deceleration to the high side of normal.

Step 3) Set the derivative gain to zero, which disables the derivative term. I have never actually needed to use the derivative term.

Step 4) Set the integral gain to zero. This disables the integral term.

Step 5) Set the proportional gain to zero. This disables the proportional term.

Step 6) Set the feed-forward gain such that the system can reach, say, 33 percent of the desired goal. (I use this for speed control of a turntable. I use a tachometer as feedback.)

Step 7) Set the proportional gain such that the system can reach, say, 66 percent of the desired goal. (Or increase the proportional gain until the system starts to oscillate. And then divide the gain by 2 and the oscillation should stop.) This is now your initial proportional gain. This is just a starting point. So you can now start experimenting with the integral gain.

Step 8) Increase the integral gain such that the system can reach 100% of the desired goal. If the gain is too high, you will have excessive overshoot. You will almost always

have some overshoot when you use integral gain. You want the gain high enough so that the system can reach its desired goal in an acceptable amount of time.

Step 9) Set the acceleration and deceleration low enough that overshoot is not an issue.

Step 10) Try different combinations of settings to see if you can find a better setting.

Step 11) As a last resort, you can now experiment with derivative gain. The idea is that if the error ($error = goal - actual$) is shrinking too fast, then we want to back our foot off of the accelerator pedal. This can apparently be used to compensate for overshoot caused by the integral gain.

The steps above are only one technique of many for tuning a PID control system. Some techniques rely on the derivative term/gain, instead of using it as a means of last resort. For example, controlling the temperature of a water heater with a large tank is different from controlling a motor, because the temperature will take a long time to respond to the source of heat. This can apparently make using the integral term very challenging. So different problems require different solutions.

Also it is sometimes possible to build a self-tuning PID controller. You can use this when programming your AI opponent so it can adapt to someone's style of play.

Consider whether you would be better served with a hybrid (analog-digital) PID control system, where the proportional and integral terms are handled by a digital microcontroller, and the derivative term is handled by an analog computer.

A PID control system is only one of many control systems. Consider whether an entirely new method would work better. Consider a fuzzy logic controller. Consider an expert system. Consider a hybrid fuzzy logic controller / PID controller / expert system.

Another parameter you need to consider is the sample rate. You might want to start with 100 Hz and experiment with higher and lower values, and see how it works.

CoCoBits: STEM by Salvador Garcia

Late last year I was having an email conversation with some GCCC members and the term STEM and its relationship with CoCoFEST! came up. Our honorable president asked "What is STEM?"

As someone who is involved with educational related events, STEM is second nature to me, but I sometimes forget that the world is vast and everyone keeps busy with different areas of expertise. STEM stands for Science, Technology, Engineering and Mathematics and is an initiative or movement to promote these fields amongst young people.

Some years ago, some researchers determined that the United States was falling behind in producing qualified people in diverse engineering areas. Many of the better engineering positions were going to people that had been educated outside the US. Many young people were preferring easier, shorter careers or careers that encompassed other fields, such as law and medicine. This shortage of engineers needed to be addressed and thus, STEM came about.

STEM consists of presenting events, activities and projects to young people to motivate them to embrace a technical career in an engineering field. Locally, in the Chicago area, the Museum of Science and Industry (MSI) has adopted a major event which they call Robot Block Party for this purpose. Educational institutes are invited to have their robotics teams present their projects. This event typically takes place in April. Check out their Website for more information.

Elsewhere, the For Inspiration and Recognition of Science and Technology (FIRST) organization was founded. This organization provides the infrastructure needed so that schools from K through 12 can form robotics teams. FIRST has different categories based on age. The younger kids get to play with LEGO bricks and possibly with more advanced products such as the WeDo. Older kids graduate to using the LEGO Mindstorms and finally, the eldest high school level students get to design robots from scratch.

The FIRST organization creates yearly robotic challenges where the kids need to design a robot that can accomplish a specific task. The high school category, called FIRST Robotics, is involved in every stage of the design and creation of the robot. Since these robots can get to be expensive, the students and their mentors seek out sponsors. Some of the sponsors include Google, Motorola, Caterpillar, Baxter, John Deere, the University of Illinois at Chicago, and the Illinois Institute of technology, among many others.

Schools and libraries (and now even book stores) feature events called "Science Days" or "STEM Expos" where students and adults are invited to present their projects. MAKE, the people behind MAKE Magazine also feature Mini Maker Faires and their much larger brethren Maker Faires where people come together to present what they have built. The Maker Faires are not limited to engineering projects, involving other fields such as crafts, art and mechanics, just to name a few.

And what does all of this have to do with the CoCoFEST!? This venerable event can be seen as a STEM event because it involves knowledge, design and engineering. In short, it is an educational event where young and old, newbie and veteran go, not only to share their knowledge and experience, but also to

learn. As the promotional information says, CoCoFEST! is a celebration. It celebrates the legacy, the knowledge, and the community. It perfectly represents what STEM is all about.

This year, for the first time, the CoCoFEST! organizers decided to make the event more student-friendly by waiving entry fees for students (with a valid student id) 21 years old or younger. We are hoping that this motivates more people to come and see what this event is about. Although the goal is to get the young guests to take an interest in the CoCo, we hope that they take an interest in electronics, in computer programming, and for them to discover what is possible when they make the effort.

CoCoFEST! is a great event for people who want to learn electronics. Our fold includes brilliant s/w and h/w engineers who are happy to answer questions and pass on their knowledge. Although the technology is dated, the basic design blocks and principles hold and is a better option than designing using the latest and greatest AMD and Intel processors. Today's fantastic and advanced technology may be great for running the latest Linux and Windows operating systems, but is not tinker-friendly due to its complexity.

This unique combination makes CoCoFEST! and the CoCo community in general STEM related. As we move forward with future events that welcome an ever increasing audience I am sure that these characteristics will be leveraged to motivate young people to pursue a future in technology.

Lego WeDo: <https://tinyurl.com/y8r3wph7>

FIRST; <https://www.firstinspires.org/>

Robot Turtles

By John Mark Mobley

Robot Turtles is a board game that teaches programming to kids.

The adult plays the part of the computer and the child plays the part of the programmer. The idea is that the child can boss around the adult using programs. The adult moves the turtle following the child's program. The adult is required to make funny noises for each step in the program.

The goal is to get each turtle to its corresponding jewel. All players can win, just some may win before others. Players are also allowed to exercise an undo option by tapping a bug piece and saying "bug".

You can go forward, turn right, turn left, blast the LASER, and leapfrog.

Robot Turtles started as a Kickstarter.

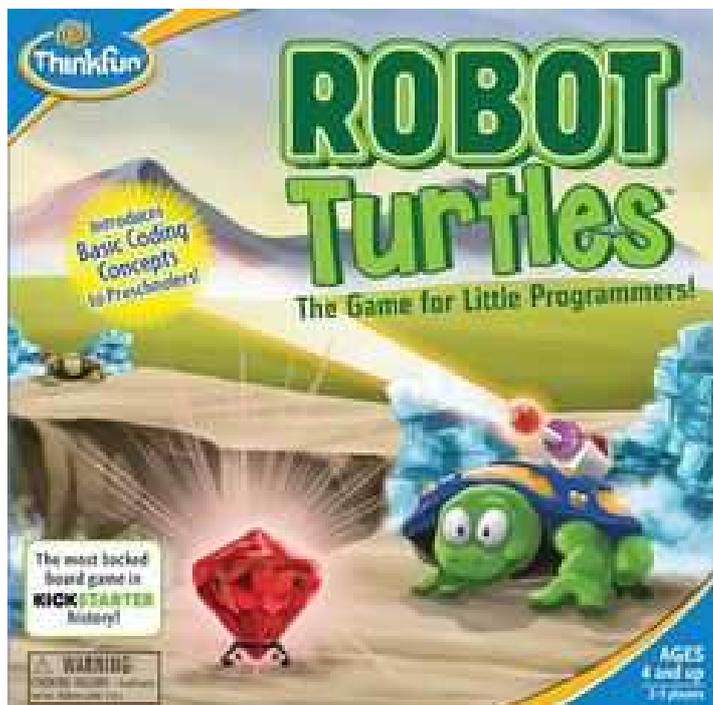
<http://www.robotturtles.com/>

Kickstarter:

<https://tinyurl.com/mmcr3ke>

YouTube:

<https://www.youtube.com/watch?v=RHjB9XQodzE>



Galena Crystal
By John Mark Mobley

Galena is the natural form of lead sulfide (PbS). The galena crystal is a semiconductor and has been used in years past to make crystal radio sets. The crystal acts as a point-contact diode (half-wave rectifier) that

makes it possible to demodulate Amplitude Modulation (AM) radio waves. It is called a diode detector because it is used to detect AM radio signals.



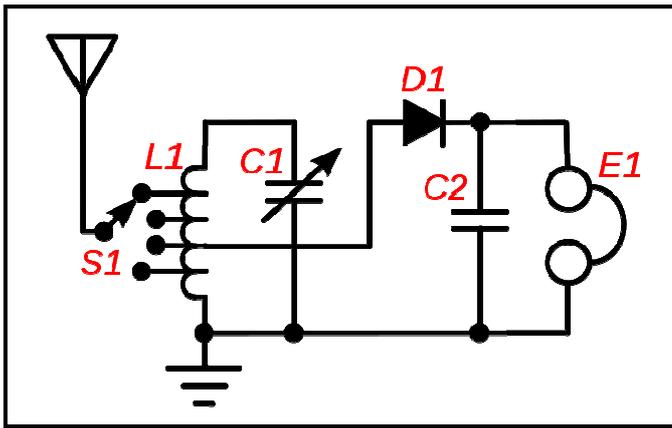
Galena
Picture obtained from Wikipedia



Galena cat's whisker detector
Picture By: JA. Davidson and obtained from Wikipedia

The radio operator must keep stabbing the cat's whisker into the galena crystal until he finds a good strong signal. See picture above. This was popular from 1905 to the 1940's.

You may also find the foxhole radio design interesting as well. In this case a rusty razor blade is used in place of the galena crystal diode.



Crystal Radio

Picture obtained from Wikipedia

The antenna is feeding into S1. S1 is a rotary selector switch. L1 is an auto-transformer/coil. C1 is a variable capacitor. L1 and C1 form a resonant circuit (like a tuning fork) that allows you to select a channel. D1 is the diode/galena crystal detector/half wave rectifier. C2 is a capacitor that acts as a low pass filter. E1 is the high impedance earphone. Having a good Earth ground is helpful to receiving a signal.

amplifier, or both. This advice comes from Bob Swoger. Bob is both a ham radio operator as well as a former employee of Motorola. Bob worked with two-way radios like the kind used in police cars. Reach out to Bob if you have any question having to do with radio. Bob also recommends building a half wavelength antenna or a very long antenna to improve the signal strength on a non-amplified crystal radio.

Advance Design Ideas...

<http://www.techlib.com/electronics/crystal.html>

Galena, Illinois is named after the mineral galena. So you can get galena from Galena, Illinois. Galena, Illinois is a great place to visit. It was the home of our 18th President, Ulysses S Grant. So see if you can make visiting Galena part of your trip to see the CoCoFEST! The point is if you need to sell the whole family on a trip to Illinois then Illinois has a lot you can work with.

Radio has advanced over the years and while I want you to remember the old simple design of the crystal radio set, I also want you to be aware of new technology. So I asked for someone to write about Software Defined Radio (SDR) and I got a volunteer. Look for an article on SDR by Fred Hicks.

John Linville's Game Master Cartridge

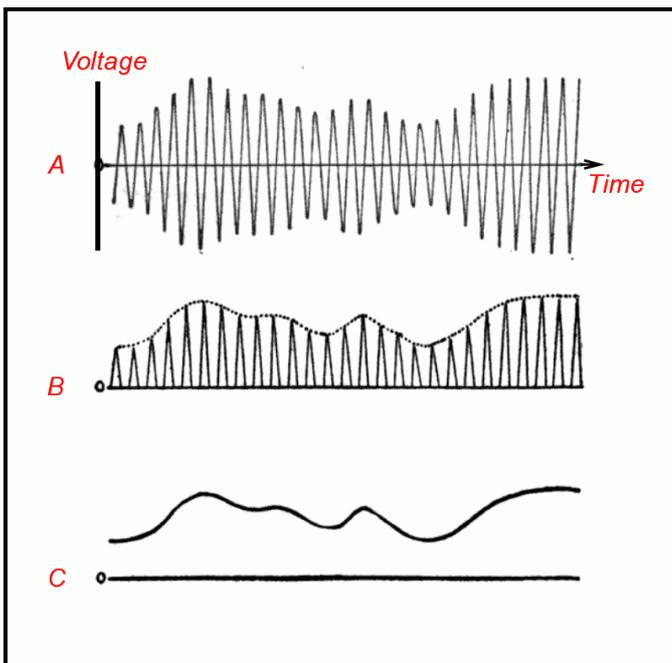
By Salvador Garcia

A Game Cartridge With an Extra Kick

There is no doubt! Games are more exciting with fantastic sound effects. However, there is a small problem with the Color Computer. For the CoCo to produce sounds, it needs to use its own CPU, the Motorola 6809 (or equivalent). When the CoCo's CPU is used to generate sounds it is not free for other tasks.

To avoid annoying delays, the CPU could multitask. That is, have the CPU perform more than one task at the "same" time. This allows a program to take care of various activities, such as process user input, update the display and of course, produce sounds. This would be the solution, but there is no such thing as "at the same time" when running a program on the CoCo (or any other computer). Each program instruction is executed one after the other. When a computer multitasks, the processor's control program jumps from one task to another, dedicating a fraction of a second to each task. This happens quickly enough so that the user perceives all of these activities as though they are happening at the same time.

Unfortunately, something has to give. The result might be a slightly unresponsive keyboard, delays in screen updating or choppy sound. A better way to resolve this issue is using a dedicated component to produce the sound, offloading this process from the CPU. The



A=RF (Radio Frequency)

B=half wave rectification of A

C=AF (Audio Frequency)

Picture obtained from Wikipedia

L1 and C1 is a resonant tank circuit with a high Q factor. Do not load down the coil and you will improve the Q factor of the tank circuit. This makes it easier to select the channel you want to hear with less cross talk from adjacent channels. Adding a high input impedance amplifier will improve the Q factor of the resonant tank circuit. It can be a RF amplifier, an AF

processor will still be busy, but at least sound is one less process that it has to worry about.

John implemented a solution to the sound generation problem by designing a game cartridge with sound circuitry onboard. Games based on his game cartridge no longer need to bother the main processor with the time-consuming task of producing sounds. Instead, the software makes use of the onboard audio component to do this. The cartridge interface provides an audio line on the expansion connector that can be used by cartridges to send a sound signal back to the Color Computer. This signal is relayed to the computer's sound generation hardware, whether it consists of a TV or dedicated speakers.

This feature in the cartridge connector allows the sound generation process to bypass the CPU. No CPU work is necessary to generate the sound. The Orch-90 and Sound and Speech cartridges, among others, use this mechanism to produce sound without the intervention of the CPU. (Editor's note: The Orch-90 is not that smart.)

John thought that a similar design could also be employed by game cartridges. His concern was cost, but the cost of the components used in the circuit was acceptable. And so the Game Master Cartridge (GMC) was born.

The CoCo-123 newsletter, Volume 37, Number 1, featured a brief mention of the GMC. This article takes a closer look at this innovative product.

The GMC

John describes the Game Master Cartridge thusly:

"A technology to enable people to produce better games"



The key word is "produce". The GMC is a container that is used by game developers to distribute their games. The end user purchases the cartridge with the game. Since the game resides on a Read Only Memory (ROM or EPROM) that is installed inside the GMC, the game and GMC are considered one item. Once out of the box, the user plugs the cartridge into the Color Computer expansion slot or into the Multi

Program Interface (MPI) and is ready to play once s/he powers up the computer. As far as the user is concerned, s/he did not purchase a GMC, s/he purchased a "game cart".

The GMC's two main resources are memory, in the form of a socket compatible with various read only memories, and sound circuitry. It is the developer's responsibility to create the code for the game and sound generation. As John mentions, a developer can simply ignore the storage memory supported by the cartridge and use it as audio hardware, but he adds, with a big "however", that this was not the intention of the GMC.

The GMC's sound generator can be programmed using BASIC, no assembly language needed here! Mike Rowen recently published two videos that briefly introduces the viewer to the programming aspects of the GMC and provides simple examples using BASIC's peeks and pokes. Having said that, assembler should, and most likely will, be used, to program the GMC, especially if the end result will be a binary file that will be burned to an EPROM

The other resource is an addressable memory space for the read only memory that's in the GMC. A limiting factor of the original cartridge games was that they could only address 32KB of cartridge memory. In 1990 Greg Zumwalt published an article in the Rainbow Magazine (June 1990) where he presented the design of a Super Program Pack that allowed a maximum of 64K addressable memory in the program pack. John based his design off of Greg's design to provide us with a cartridge that can have up to a 64KB EPROM (27C256 or equivalent).

John jokingly mentioned that a future version of the GMC might be able to address an even larger memory space. Greg's article makes mention of an enhanced Super Program Pack capable of supporting 512KB and beyond.

Developing with the GMC

A game developer whose objective is to produce a game cartridge needs to go through several stages in development:

- a. Development of the software to implement the game
- b. Cartridge design, both the electronic and mechanical aspects
- c. Production of the electronic and the mechanical components

This involves three different aspects of design: Programming, electronics and mechanics. The developer cannot concentrate on the software aspect alone. The GMC removes the second and third elements from the overall process. Using the GMC, the developer can concentrate on what s/he does best:

Code! Once the game is ready, the developer can make use of the already available GMC to package and distribute the game.

Additionally, the developer can create complex sounds using the onboard audio circuitry of the GMC without having to worry about which sound hardware, if any, the user has installed in his/her CoCo setup. The programmer can focus on creating solid code for sound effects and be confident that the hardware will be available out of the box because it is already in the box!

Products like the GMC are a milestone for the CoCo community because it facilitates and motivates development for this platform. People that are proficient in coding may not want the hassle of developing the hardware and much less dealing with PCB manufacture, component acquisition, and assembly. The GMC can make the difference for the developer when s/he wants to create a game cart, but is dissuaded from this endeavor because of the hardware's complexity.

A big boon for this product is the software component created by Tim Lindner for the MAME CoCo emulator. Tim created a GMC slot device emulation which is included with recent versions of MAME. Why is this important? A typical development cycle involves coding and then testing to debug any possible issues or simply to verify that the latest code additions are working. Since a game cart has its software in an EPROM, the development cycle includes creating the ROM image file, burning it to the EPROM, inserting the EPROM in the GMC's socket, plugging the cart into the CoCo and finally powering up the computer.

If we factor in the time that it takes to erase the EPROM so that it is ready to be re-programmed, the time and logistics become a hindrance. The 10 to 20 minutes that it takes to erase the EPROM can be mitigated by using a different read only memory technology or by having multiple EPROMs, but this doesn't make it any simpler because the developer has to keep track of which EPROM is next in line.

The MAME/GMC emulator eliminates this time consuming task by allowing the developer to test using an emulated GMC on an emulated CoCo. Having to burn an EPROM is eliminated because the developed software can be tested within a virtual environment. Another advantage of using a virtual environment is that it saves wear and tear on the original hardware.

The only caveat when using the virtual GMC is the Becker port. Tim pointed out that this feature is turned on by default and its address conflicts with the GMC. To resolve this problem the user needs to manually

disable the Becker port within MAME.

A development setup could consist of a modern computer running the development environment and the MAME CoCo emulator. To test a build, the developer builds the game to a ROM image file as usual, but instead of burning it to the EPROM, the MAME CoCo emulator is started using a command line which defines the use of the virtual GMC and the ROM file that was built.

Once the game is done and ready to go, the developer sends the ROM image to John & Co. John then burns the image to the read only memory, assembles the GMC, packages the product, and makes it available to the public. Previous negotiations with John will define the royalties that the developer will get for the game and the overall cost of the game cart. The developer can expect that using the GMC will add about \$20 USD to the game, depending on the negotiations, keeping in mind that this includes the cost of the cartridge hardware with sound capabilities. The developer would be hard pressed in rolling his own cartridge at a lower cost, taking into account the added benefits of a larger memory space and sound capability and the complexities that this would add to his or her project. The overall objective of this business model is to create a win-win situation for John and the game developer.

Under The Hood

The heart of the audio circuitry is the Texas Instruments SN76498 Digital Complex Sound Generator. This chip is also used in arcade games from Tehkan, Sega, Universal Entertainment Corporation and Konami. Home computers that used the SN76498 or equivalent included the TI-99/4A, some models of the Tandy 1000, the IBM PCjr, and Sega Genesis, among others. John decided on this specific sound generator chip based on its relatively low cost and its historical tie with Tandy/Radio Shack.

The sound generator register is memory mapped into the CoCo's address space at &HFF41. To send data and instructions to the sound generator chip the developer needs to put specially formatted bytes into this location. The sound chip can receive either one or two bytes. The data sent to the sound chip is either a volume value (0 full volume – 15 mute) or a 10-bit tone value. The volume value takes up 4 bits, so one byte can specify the volume; however, the tone value is 10 bits, so it forcibly needs two bytes to get the full 10 bits to the sound chip.

To get data to the sound chip, the byte is placed at address &HFF41 using a POKE or the equivalent assembly code. If the developer is setting a tone then this process is done twice to get all 10 bits to the sound chip.

Getting audible sound out of the sound chip is a two-step process:

1. The cartridge sound needs to be enabled by poking the correct value to addresses &HFF01, &HFF03 and &HFF23. This creates a pathway from the cart's sound line to the computer's sound generation hardware (TV, speaker, etc.)
2. Generate sound by sending data to the SN76498 as mentioned above to address &HFF41.

As was mentioned before, originally game carts could only make use of 32K of memory. John's design, following Greg's own design, can address up to 64K. This means that the GMC is compatible with EPROMs of 8, 16, 32 and 64KB.

To address more than 32K, the GMC uses bank switching. It divides the memory address space into 4 blocks (or banks) of 16K each. The register that is used to control the bank switch is mapped to address &HFF40.

Since the GMC is designed to be a game cart, the CART* signal on pin 8 of the expansion connector is used so that the CoCo can detect the presence of the cartridge on power up. When the cartridge is detected, execution flow is directed to the cart's code starting at address &HC000. This is why the CoCo automatically starts playing a cart's game when it is powered on.

As Mike Rowen discovered, this can be a problem if the owner of the GMC just wants to tinker with its audio capabilities and installs the GMC without having an EPROM installed. The CoCo blindly transfers execution to the non-existent code and the CoCo ends up in Neverland. The remedy to this predicament is simple: Place a small piece of tape over pin 8 of the edge connector of the GMC to disable the CART* signal.

In Closing

The GMC is an innovative piece of hardware because it helps developers past a hurdle that might otherwise hamper their enthusiasm in developing a game cart.

John is making special developer kits of the GMC available to developers at a reasonable cost. This item is meant to put the GMC in the hands of the developer so that s/he can use it as a tool to develop and test his/her game, along with other resources such as the MAME/GMC emulation.

I hope that products like the GMC motivate more people to join the CoCo community by developing new products.

Special thanks go to Tim Lindner for taking the time to explain the GMC emulator in better detail and verifying the relevant information in this article, and to John

Linville for his counsel in making sure that I understood some aspects of the GMC.

Links

Mike Rowen's video, part 1 and part 2:

<https://youtu.be/mGaaDpZ-M3c>
<https://youtu.be/TrxqOz7dJ5I>

John's presentation for CoCoFEST! 2017:

<https://youtu.be/ZsTBSgQRX9o>

John Linville's blog:

<http://retrotinker.blogspot.com/>

Want your GMC? Contact John at:

Email: linville@tuxdriver.com or

linville@gmail.com

Facebook: John W. Linville

Twitter: @JohnWLinville

Game Master Cartridge Enables Better Games for CoCo

By John Linville

Anyone with at least one foot in the Tandy Color Computer (CoCo) world these days will have already been hearing about something called the Game Master Cartridge (GMC). What is this device? Another whiz-bang flash-in-the-pan hardware announcement with little real utility? Or is this a good and useful product that everyone should acquire for their CoCo collection? Well, as the designer of the GMC I will say that it is perhaps neither...or maybe it is both?



To start, the GMC is not really a consumer product at all. The GMC is more of a technology, one designed to solve a particular set of problems. For most folks, the only way to acquire GMC technology will be to buy a game cartridge with the technology built into it.

In particular, the GMC is designed to enable better (i.e. more entertaining) cartridge games on the CoCo with only a modest increase in price versus a "normal" game cartridge. For many collectors, cartridge games offer a tangible quality that makes them prized parts of a retro computing collection. When the cartridges are built around GMC technology, they can truly offer a game experience that would be unavailable otherwise.

So what is the big deal? Cartridges have existed for the entire life of the CoCo. How is the GMC technology different? Well, normal cartridges for the CoCo 1 and CoCo 2 are limited in storage capacity to about 16K. The GMC extends that through the time-honored technique of bank switching, expanding available storage to nearly 64K on the cartridge. Combined with the ability of the CoCo 1 and CoCo 2 to run at faster clock speeds while executing programs on a cartridge, and this feature alone is enough to justify claims of enabling bigger and (hopefully) better CoCo 1 and CoCo 2 games with more graphics than ever before and at the fastest speeds possible. Even on the CoCo 3, no other cartridge solution currently in production offers any more storage than the GMC.

But...what really makes the GMC special is the inclusion of an on-board TI SN76489 Digital Complex Sound Generator. Used in the BBC Micro, the Sega Master System, the ColecoVision, the Tandy 1000, and a number of other vintage systems, this little chip punches above its weight. With this hardware on-board, the GMC offers continuously playing music and sound effects for games on any version of the CoCo. Easily programmed and at worst only requiring software service during vertical sync periods, this heroic little chip can add to a game enjoyable music in 3-part harmony (plus a noise/percussion channel) without requiring complex cycle counting or tricky interrupt handling. This little gem can add value to nearly any game while requiring very little time or effort from the game's creator.



In my mind, perhaps the best part of the GMC is its affordability. Depending on packaging, there will always be real, upfront costs associated with producing game cartridges. Plastic cases, electronic parts, PCBs, boxes, manuals, etc all take their toll. Fortunately, the bank-switching bit of the GMC only requires a little 74xx-series logic and a bigger ROM chip. Moreover, the simple little SN76489 only needs one more 74xx-series chip and a few miscellaneous electronic parts to do its job in the GMC. Yes, the design is "period correct" (a.k.a. "old skool") — no CPLDs or FPGAs here, and no surface mount parts! In the end, even at current eBay prices the GMC technology only adds ~\$3 to the cost of building a cartridge. That price is well worth it for the extra value provided!



If you are thinking of writing a CoCo game, by now you must be wondering how to take advantage of the Game Master Cartridge technology for your own creations. For most, the simplest way to start is by using MAME. There, emulation of the GMC is already fully implemented thanks to Tim Lindner. Those that feel the need to test on real hardware can reach-out to me (John Linville <linville@tuxdriver.com>) to inquire about the availability of developer kits. Further, anyone that completes a GMC-based game and is ready to ship cartridges to the CoCo community can likewise contact me for production details.

The CoCo may not be well-known as a game platform. But I assure you that under the control of the right software package, the CoCo can provide hours of wholesome video game entertainment. Beyond that, writing 8-bit game software for the CoCo is a joy for those of us that love the machine. Anyone that goes to such effort will want to provide the best gameplay experience possible to those that play their creation. Producing high quality and entertaining music and sound effects for a game on the CoCo can be difficult, even on the CoCo 3. Now, the GMC technology for the CoCo puts enjoyable music production within the reach of any competent programmer without requiring a background in music.

Cartridge games based on Game Master Cartridge technology will be available at CoCoFEST! in Lombard, IL on April 21-22, 2018. Come out and get them all!

Starting out with Software Defined Radio (SDR) By Fred Hicks

When I was younger one of my favorite hobbies besides programming BASIC on my CoCo2 was my handheld CB radios. I had a small collection of hand held units from Uniden and Radio Shack (Realistic TRC-219). This led to my overall interest in radio communications. As I got older my exposure grew to a

handheld scanner listening to local police and fire department communications and then my first 10 meter ham radio base station.



When my interest in RF communication resurfaced again later in life. It was at the marvel of SDR (Software Defined Radio). I was introduced to the concept by a colleague who was using it in place of his hand held scanner. Starting out was easier than I had thought. Looking at several options that easily surpassed a couple hundred dollars I found that could set up a receiver rig for less than 20 dollars.



With the intelligence all in software I found that I could pair a free software package called SDR# (www.airspace.com) with a cheap receiver dongle with a compatible chipset. I picked up mine from Amazon:

(<https://www.amazon.com/gp/offer-listing/B00C37AZXK>)

I could program the rig to scan from around 24 MHz up to 1766 MHz. A few examples of signals you can pick up are FM radio, police frequencies, ham radio, aircraft communications and a whole lot more.

The beauty of SDR# is you can set a frequency range in the analyzer window and tune the gain to see peaks that can be clicked on to listen to. As an example here I am tuning in between 87.5 MHz to 108 MHz, the FM radio band.



By clicking on any of the peaks I can quickly zero in on my local radio stations. Zooming in and out on the analyzer gives me good insight as to what is available to listen to. I can see that there are a couple stations I can tune into. The new version of SDR# includes labels as to what is usually found in the frequencies you are in. Installing SDR# is pretty easy but it has a few manual steps which are covered in more detail at <https://www.rtl-sdr.com/rtl-sdr-quick-start-guide/>.

Just a couple of tips if you're starting out with SDR. Replace the stock antenna with something better. This will greatly improve reception. Do not install the drivers that come with the dongle from the manufacturer. Lastly is to make sure you increase the gain in the configuration menu (the cog icon). The default settings will not pick up anything. I usually start with 20dB. Good luck and enjoy SDR.

Ready Player One the Movie

By John Mark Mobley

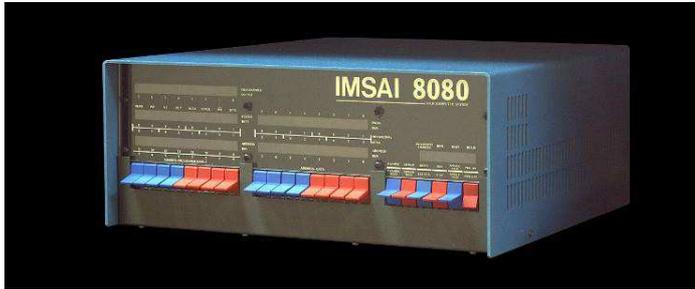
Ready Player One the movie is due out on or around March-27-2018. The book is set in the year 2045 but is filled with 80s nostalgia including vintage computers. The audio book was 15 hours and 46 minutes long but the movie is only 2 hours and 20 minutes long so the movie will have to leave some things out. Many people have warned me not to get my hopes up that any of my favorite vintage computers will get mentioned in the movie as they were in the book. This movie may be a way to bring up a discussion about vintage computers and vintage computer festivals.

The book and movie are built around Virtual Reality (VR). Where you can visit 1000 different worlds. And each world has its own rules. The possibilities are many. In the book you would typically interact more with someone's avatar rather than with the actual person. You could even go to school or work using VR. You can even acquire virtual possessions and carry them with you from one virtual environment to another.

Movie Trailer:

<https://www.youtube.com/watch?v=dtwpjnuvTE>

I could potentially live another 27 years. What will the future be like in 2045? How much of this work of science fiction is actually possible? Would you want to live in a virtual world?



IMSAI 8080

Picture obtained from Wikipedia

What if you could emulate an IMSAI 8080 with all its front panel switches and LEDs using VR and haptic feedback?

CoCo Happenings

By Salvador Garcia

2017-12-24 John Strong announces on the Facebook group his first CoCo3 FPGA case prototype.



2017-12-29 John Linville announces on the Facebook group that his Game Master cartridge is now in production



2018-01-05 Darren Atkinson announces on the CoCoList that his new port, Asteroids, is now available for the MC-10 and can be downloaded at the following link: <https://goo.gl/BxouGw>

2018-01-09 Mike Rowen announces on the CoCoList that he posted a video presenting a short demo of John Linville's Game Master Cartridge which also includes some technical information:

<https://youtu.be/mGaaDpZ-M3c>

2018-01-10 Darren Atkinson mentions on the CoCoList that Jim Gerrie posted a YouTube video presenting his Asteroids game:

<https://youtu.be/xUW2kikoKj0>

2018-01-13 Neil Blanchard announced on the Facebook group the availability of John W. Linville's cost reduced version of the CoCo Sega Genesis JoyPad/Joystick Adapter. Contact Neil at neil@cococrew.org for more information.

2018-01-17 Guillaume Major announced on the CoCoList that a first draft of the MLBASAIC 2.0 documentation, a BASIC compiler by Wasatchware, is ready for download. Thank you Guillaume, Steve Ostrom and Carlos Camacho for your work in making this document available.

<https://tinyurl.com/y7ruy2t7>

2018-01-28 Steve Strowbridge posted on the Facebook group the link to a Google world map that contains a pin for each registered CoCo user. If you are a CoCo user and not registered on this map, and would like to join the crowd, contact Steve to be added. Provide name and address.

<https://tinyurl.com/ya3hbabp>

2018-01-30 Mike Rowen announces on the CoCoList that part 2 of John Linville's Game Master Cartridge demo video is now available at YouTube. This segment includes a discussion on using Extended BASIC to generate sounds:

<https://youtu.be/TrxqOz7dJ5I>

2018-02-07 Carlos Camacho announces that he got in touch with Brian Moriarty, a former Infocom programmer who was in possession of Infocom's 6809 interpreter. Brian gave Carlos documentation and files which were subsequently put up on the CoCo archive. Search for Infocom interpreter.

2018-02-09 Rietveld posted on the CoCoList the peeks necessary to determine which arrow key has been pressed. He mentioned that these addresses need to be polled and checked for a value change:

Up arrow: IF peek(341)=247
Down arrow: IF peek(342)=247
Left arrow: IF peek(343)=247
Right arrow: IF peek(344)=247

2018-02-11 Rietveld posted on the CoCoList a link to a video where he demonstrates his point n' click menu for the CoCo Flash:

<https://youtu.be/V4JX0A6nReY>

Download link: <https://tinyurl.com/y7pjuwdp>

And some indications:

Just change the DATA in LINES 440-620 to match what/where your ROM BINs are flashed.

Edit N\$ in LINES 1501-1599 to speak the name of the ROM PAK. 1501 is MENU entry 1, 1502 is MENU entry 2, etc. 1599 is MENU entry 99. 1500 is MENU entry 100 (if used).

RUN 60000 to create BASROM

2018-02-12 John Linville posts on the CoCoList a link to his blog entry detailing his experience with the Infocom Interpreter:

<https://tinyurl.com/y9m6rps2>

2018-02-16 A blast from the past, sort of. John Mark Mobley posted a link to a short video snippet of the TV series Young Sheldon when the main character and his family are in a Radio Shack store:

<https://youtu.be/8gl0y4Fn884>

Is that a CoCo in the background in front of the window at 1:44?

2018-02-24 Leslie Ayling announces on the CoCoList the availability of the Frank Hogg Labs E-Forth which has been patched to run on the CoCo 3 FPGA, VCC and Jeff Vavasour emulators:

<http://www.crisis.com.au/images/EFORTHKB.zip>

2018-02-26 Rietveld posted on the CoCoList a link to a video that demonstrates using the CoCoFlash to launch DriveWire:

<https://youtu.be/HrcimNnT1lo>

And another on moving files between the CoCo SDC and DriveWire:

<https://youtu.be/-MnIHVwMx04>

2018-03-06 Allen Huffman posted to CoCoList and Facebook a link to his video where he presents a demonstration of his Work in Progress, SirSound:

<https://www.facebook.com/subethassoftware/videos/1711894792204849/>

2018-03-07 Rietveld posted on the CoCoList a link to a video where he demonstrates basic usage of the WIMGTOOL to copy files into DSK image files:

<https://youtu.be/HK8gliBrRno>

2018-03-12 Allen Huffman announced on the CoCoList that he posted two more videos about his SirSound project:

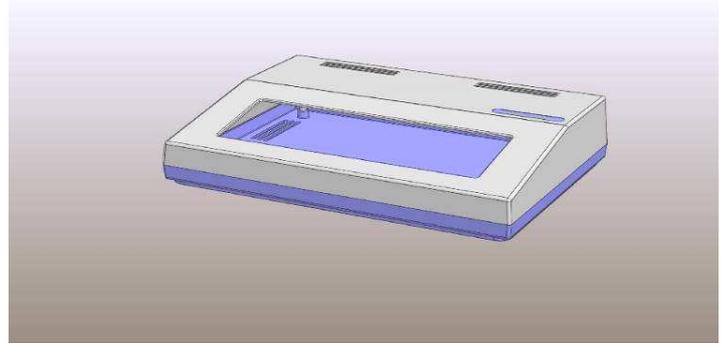
SirSound demo 1- introduction: This 7-minute video walks through the basic concept of the device, and shows how easy it is to convert BASIC "PLAY" music to use the SirSound device.

<https://www.youtube.com/watch?v=l8hjJbdafI8>

SirSound demo 2 - polyphonic music: This 4-minute video shows how multi-voice music will be handled. It demonstrates 3-part harmony, and also a quick version of the Frogger arcade game theme music, all from BASIC.

<https://www.youtube.com/watch?v=vZX-nF39OvA>

2018003-15 Ed Snider presented on the Facebook group a concept image of a possible alternative CoCo case that he has been working on:



2018-03-16 Carlos Camacho posted the following message on the Facebook Color Computer group:

“CoCoFEST! is an expo focused on the Color Computer held in Illinois in April. Despite starting with a CoCo since the first model, I had never been to this show. Last year was my first attendance. Having been away from the CoCo world for many years, I didn't know anyone at the show. I didn't know what to expect..... [Steve Bjork](#) riding an ATV? Classes on using Color Script? 99 reasons to switch to NitroOS? Watching someone explain their 1GB MC10 RAM project? Actually, I knew some names through this [Facebook] group. It was interesting to get to better know those folks. I bought lots of old books (my assion) and other trinkets. The lectures were also cool. I had most fun during the auctions.... watching old friends fight for stuff they wanted and things they really didn't need. I joined [Neil Blanchard](#), [John W. Linville](#), [Boisy Pitre](#) and others for a lunch. This post is aimed at someone who has never been to the show and wondering if they should go. Or are on the fence to go for the first time. Please ask questions here so we can convince you it's worth the trip. With such a huge spike in new members and many cool projects for an old platform, joining this event is the best way to make this platform better (more fun).”

2018-03-20 Guillaume Major announced on the CoCoList the availability of version 0.45 of his CoCo SDC control program SDCX. Look for March 19, 2018 entries:

<http://www.colorcomputerarchive.com/>

Calendar of Events

by John Mark Mobley and Salvador Garcia

See our website's Calendar of Events:

<http://www.glensideccc.com/calendar/index.shtml>

Glenside Color Computer Club, Inc. Business Meetings

Thursdays, Apr 12, 2018 and May 10, 2018

7:30 PM to 9:30 PM Central Time

Schaumburg Public Library

130 South Roselle Road

Schaumburg, IL, USA

Blue Jeans teleconferencing access is available via John Mark Mobley or John Linville. You can call in.

April 21-22, 2018

The 27th Annual "Last" Chicago CoCoFEST!

Tandy Color Computer Festival

Heron Point Building

Lombard, IL, USA

Link: <https://tinyurl.com/y8zrdyw4>

April 21-22, 2018

Vintage Computer Festival Southeast (VCFSW)

It's in the Roswell Town Center mall

Roswell, GA 30076

<https://tinyurl.com/hxbm4r6>

May 18-20, 2018

Vintage Computer Festival East (VCF East)

InfoAge Science Center

Wall, NJ 07719

<https://tinyurl.com/h6culjk>

June 9-10, 2018

Pacific Commodore Expo (PaCommEx)

Living Computers Museum & Labs

Seattle, WA

<https://tinyurl.com/gowcnvy>

July 16-22, 2018

KansasFest

Apple II Computer Festival

Rockhurst University

Kansas City, Missouri, USA

Link: <https://www.kansasfest.org/>

August 4-5, 2018

Vintage Computer Festival West (VCF West)

Computer History Museum

Mountain View, California

<https://tinyurl.com/yc8znyqy>

August 11, 2018

Commodore Vegas Expo (CommVEx)

Plaza Casino

Las Vegas, NV

<https://tinyurl.com/c9taggu>

The 27th Annual "Last" Chicago CoCoFEST!



CoCoFUSION

Here are the 5 "W's"

WHO? 1) Glenside Color Computer Club, Inc. PRESENTS

WHAT? 2) The 27th Annual "Last" Chicago CoCoFEST!

WHEN? 3) April 21 & 22, 2018

(Sat. 9 am to midnight - Sun. 9 am-3 pm)

WHERE? 4) Fairfield Inn & Suites Lombard

645 West North Avenue

Lombard, IL 60148

(Near the intersection of IL-355 and North Avenue)

(Same location as 2017!)

Overnight room rate:

\$94.00 plus 11% tax (\$104.34 Total)

Call 1-630-629-1500 for reservations.

You must ask for the Glenside "CoCoFEST!" rate.

>>> YOU MUST REGISTER UNDER "CoCoFEST!" <<<
>>> TO GET THIS RATE <<<

WHY? 5)

- A. To provide vendor support to the CoCo Community
- B. To provide Community support for our CoCo Vendors
- C. To provide educational support to new users.
- D. TO HAVE AN OUTRAGEOUSLY GOOD TIME!!!

And now, the "H" word.

HOW MUCH? All Attendees - General Admission

Both days: \$15.00 1st - \$5.00 2nd & more

Sunday Only: \$10.00 1st - \$5.00 2nd & more

***** Children 12 and under - FREE *****

*** Students 21 and under with valid Student ID - FREE ***

For further information, general or exhibitor, contact:

Tony Podraza, GCCCI Robert Swoger, GCCCI

847-428-3576, VOICE 630-847-7026, VOICE

tonypodraza@gmail.com rswoger@aol.com

Be sure to visit our Website to see up-to-date information on upcoming events. <http://glensideccc.com>