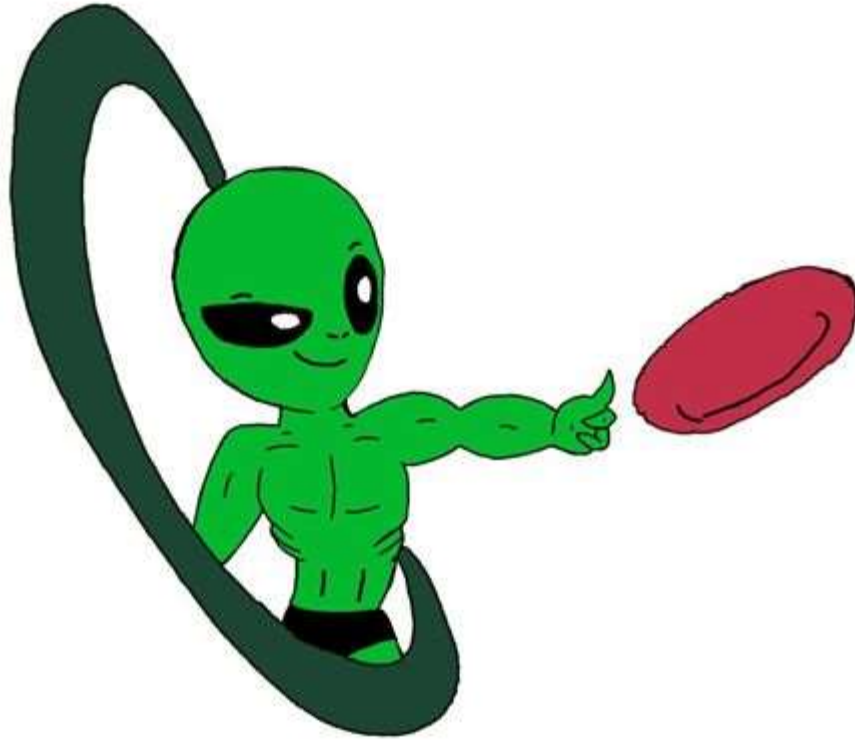# AREA 53

ERHS Robotics

VEX Team 53C

Charlie Dawson

Audrey Rappaport

Miles Campbell

**Tyler Clarke**

Daniel Hamilton

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Introduction

The Atari 800 is one of the first widely available home computers. Released in 1979, it was far superior to its main competitors, the Apple II, TRS-80, and Commodore PET, with the best sound and graphics capabilities of the day. All the members of Team 53C had seen the inside of a modern computer, so we wanted to take a look inside the great-great-grandfather of our modern desktops, to see what was the same and what was different. In addition, the large components make them easy to identify and determine their purpose.
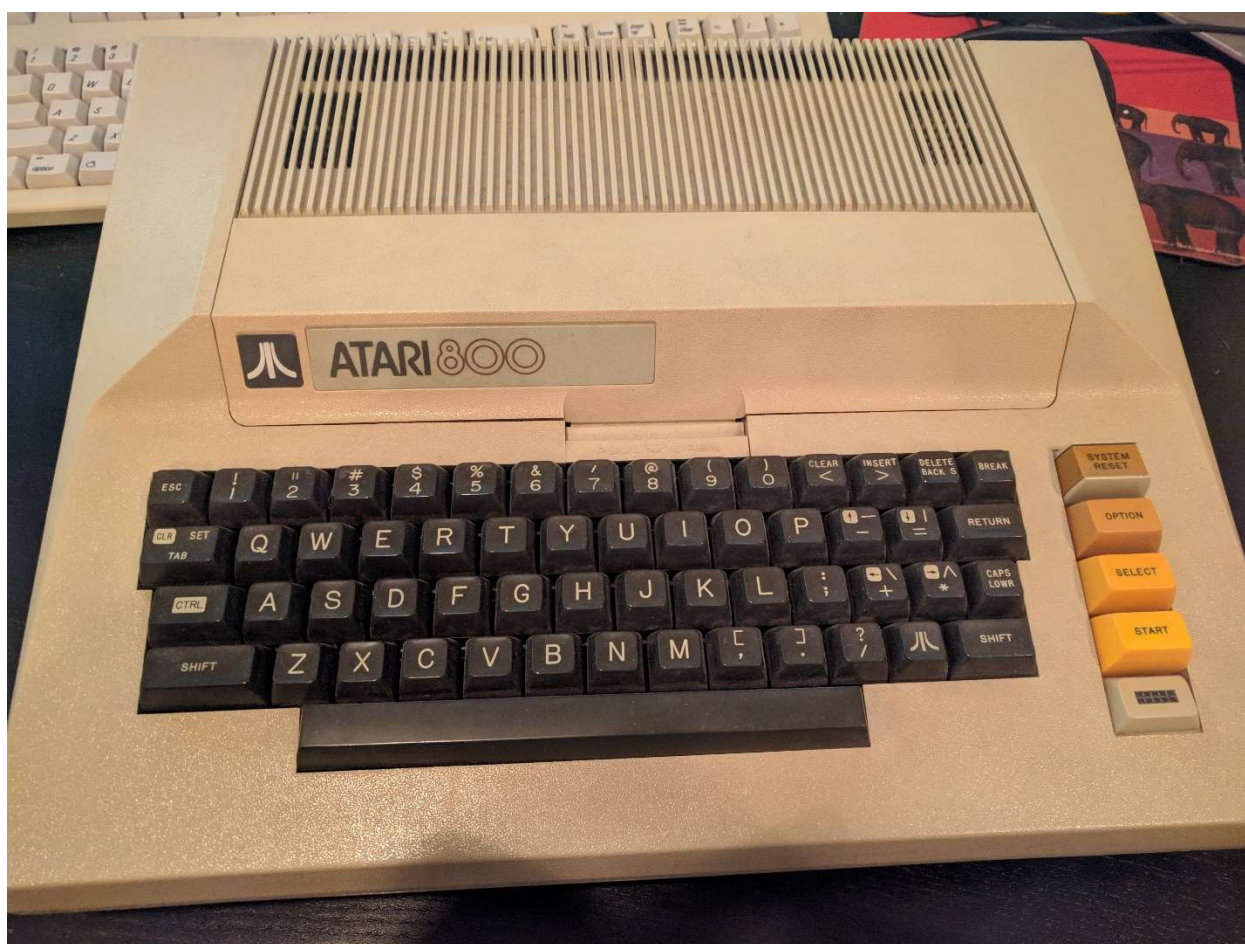
The Atari 800 we will be taking apart today. I hope it still works after this ordeal is over…

Composite Video-Out

SIO Port

Ch 3/4 Selector

Power Switch
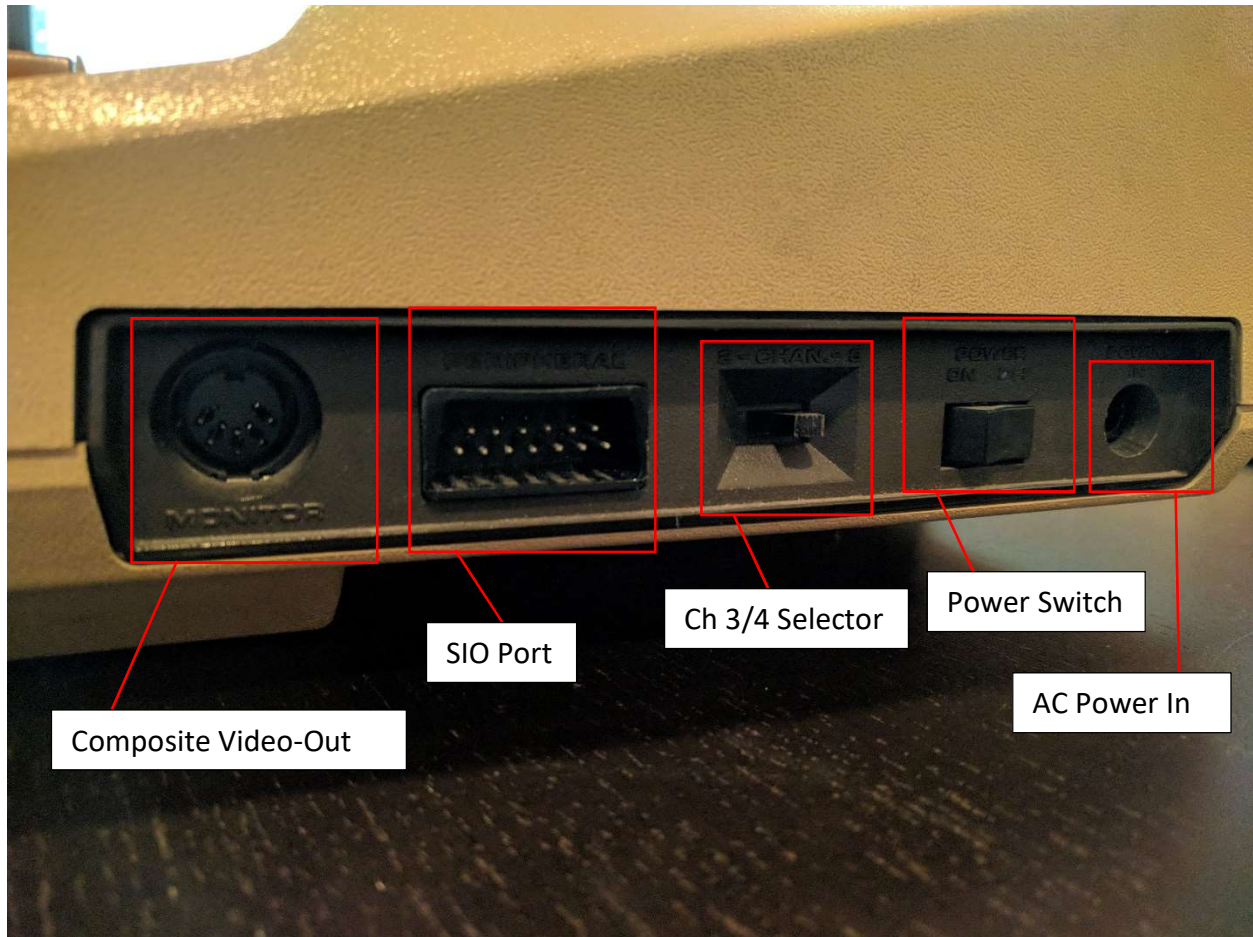
AC Power In

The composite video-out, channel selector, and power switch are all self-explanatory. "AC Power In" is not a typo—although this looks like a DC jack, the Atari 800's power brick actually supplies 9V AC to the computer. The rectifier converts the power to DC is inside the computer, and will be shown later. The Serial IO, or SIO port is the most interesting. SIO is in many ways a precursor to USB, and allowed for expansion without the use of cards.
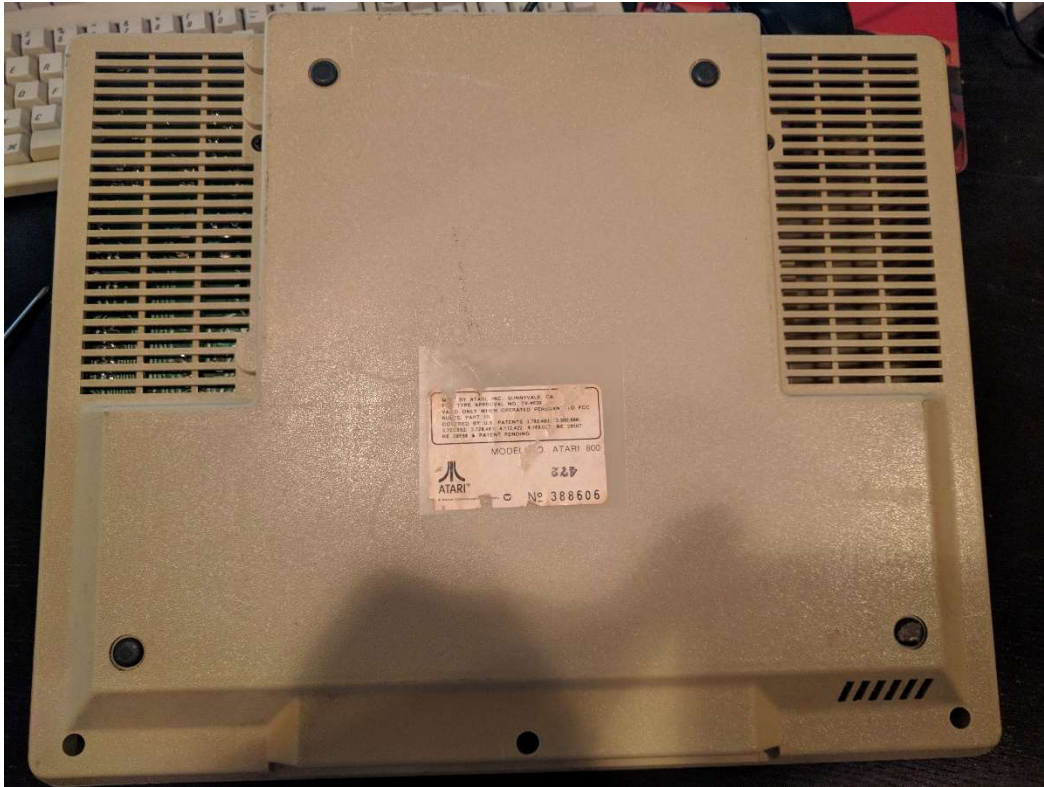
The Atari 800's bizarre double cartridge slots. The right slot was never really used for anything.
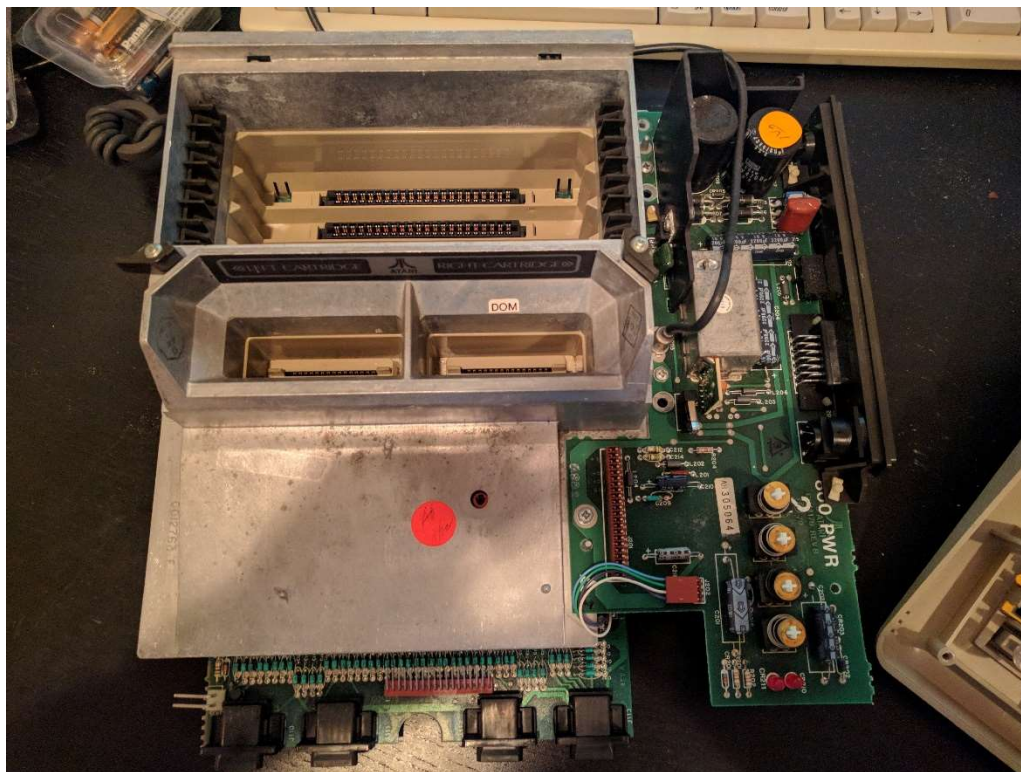

WOW! 48 kilobytes of RAM!

Disassembly

Taking the bottom case off

There's not much to see yet, except for an obnoxious speaker that clicks every time a button on the keyboard is pressed. It is circled in red.
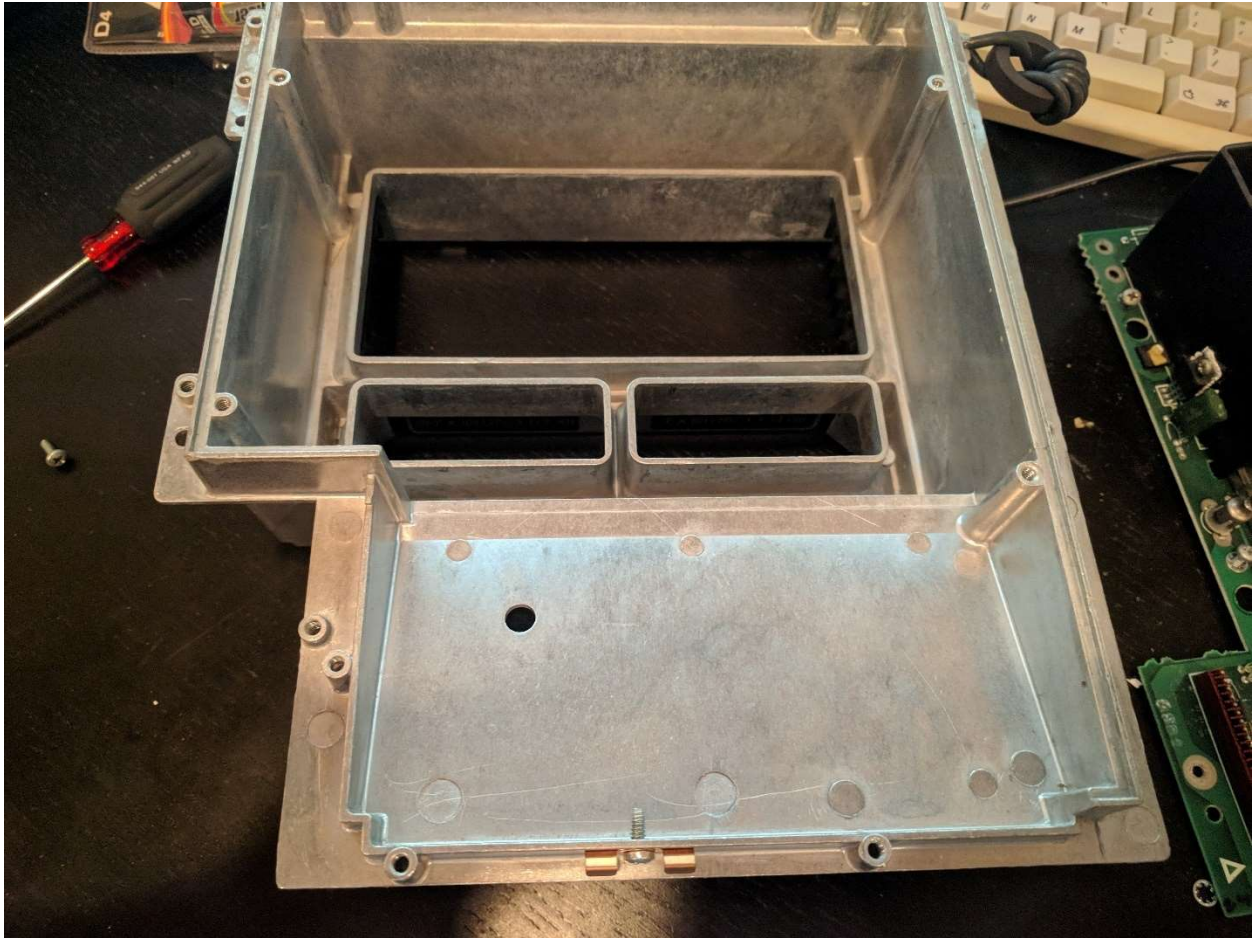
The Atari 800 motherboard

*Who doesn't love a good mechanical keyboard?*

When the RadioShack TRS-80 came out, it emitted so much RF interference that clever programmers could manipulate the hardware to play sound over a radio placed near the computer. As a result, the FCC decided to crack down on computer RF emissions, resulting in Atari needing to design a ridiculous RF shield. It is made from solid aluminum, and is quite heavy. This shield made it difficult for Atari engineers to add expansion card slots, leading to the development of the SIO port to replace that capability. The FCC soon loosened its regulations, and later computers were far less extreme.
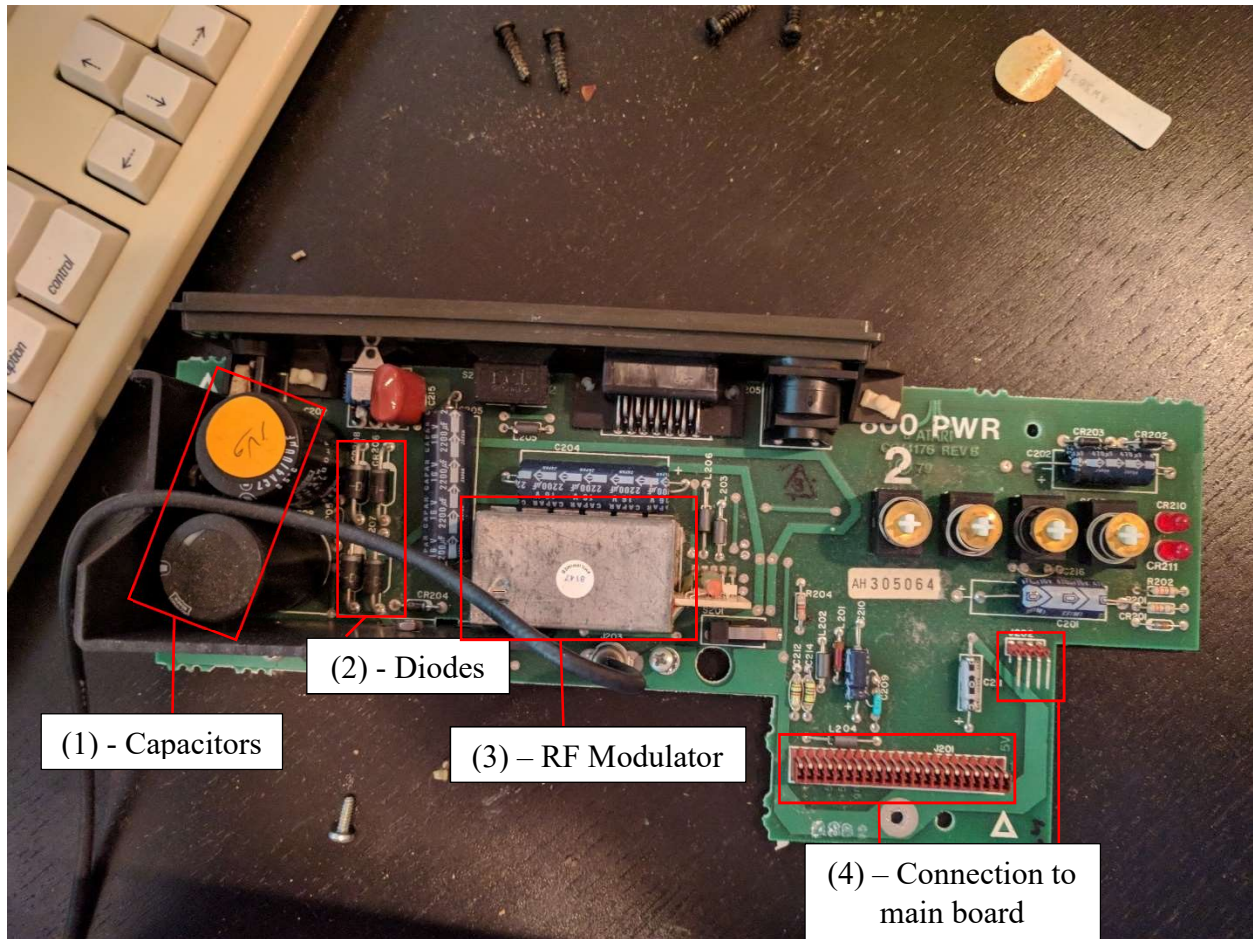
This is the power and I/O board. It takes the AC power input, and converts it to the DC power the computer can use. The important components are highlighted, which are:

1. Capacitors – These capacitors are the main power capacitors, which is why they are so large. They serve as a filter to smooth out any fluctuations in the current; smooth current is critical for computers to run stably. These can be *very* dangerous, and we took care not to discharge them with our fingers.
2. Diodes – The diodes only allow current to flow one way. They form the main part of the rectifier, converting AC into DC.
3. RF Modulator – The RF modulator takes the composite video signal from the computer's video chip and converts it to a TV signal, allowing any TV set to channel 3 or 4 to act as a monitor.
4. Connection to Main Board: These bring power to the main board and send video and audio to the RF modulator. They also connect the SIO port to the controller chip.
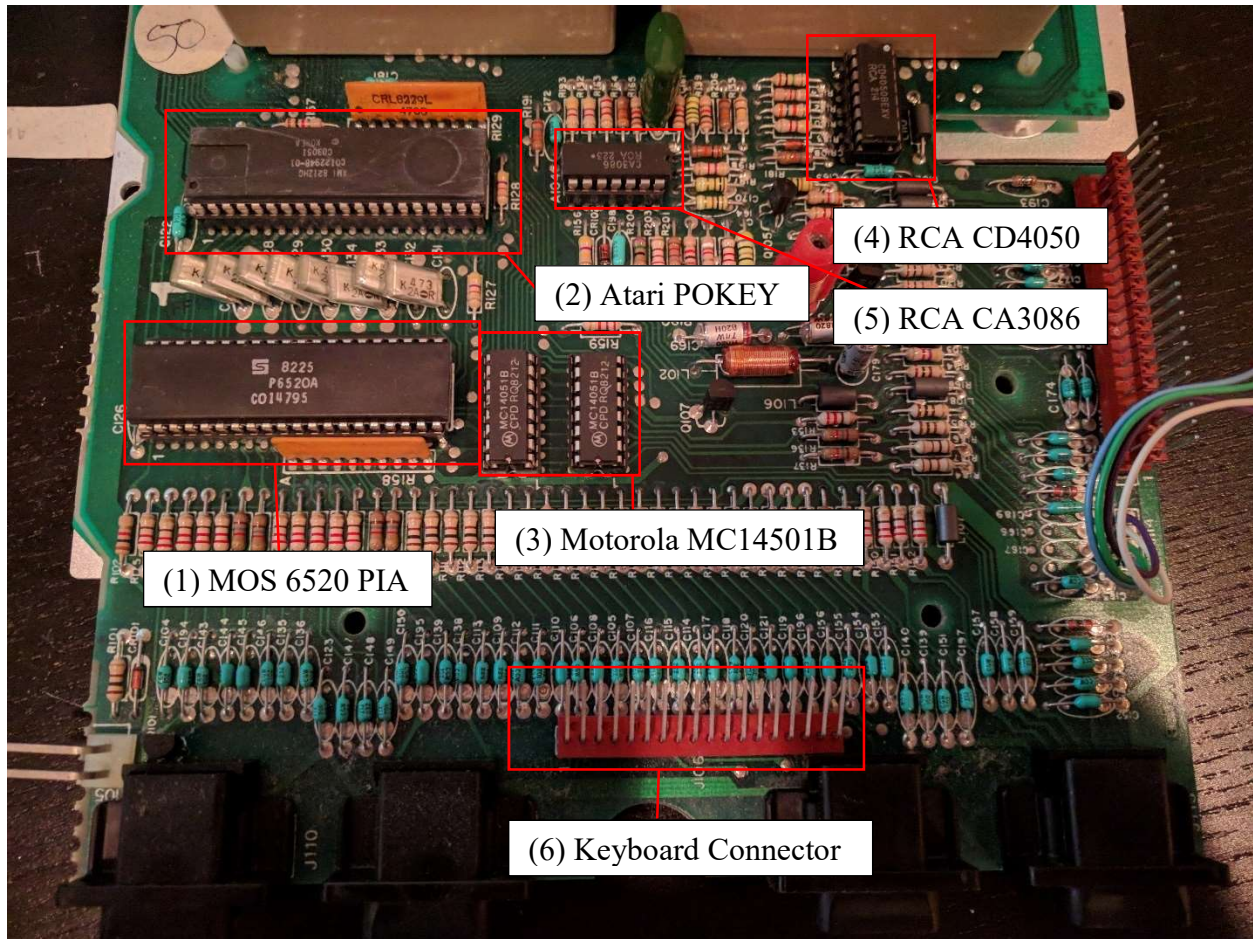
The Atari 800's main motherboard.

1. MOS 6520 PIA – The 6520 is a peripheral interface adapter. It takes input from the joystick ports and passes it to the CPU, where it can be processed.
2. Atari POKEY – The Pot Keyboard Integrated Circuit, or POKEY is the Atari's sound chip— but it is one of the most advanced and versatile chips in the computer. It is also responsible for managing input, from controlling the SIO port, to interpreting keypresses and game paddles. It has 4 square-wave voices.
3. Motorola MC14501B – An Analog Multiplexer/Demultiplexer, or in less fancy words, electrically controlled switches.
4. RCA CD4050 – IC Hex Buffer
5. RCA CA3086 – Transistor Pack
6. Keyboard connector
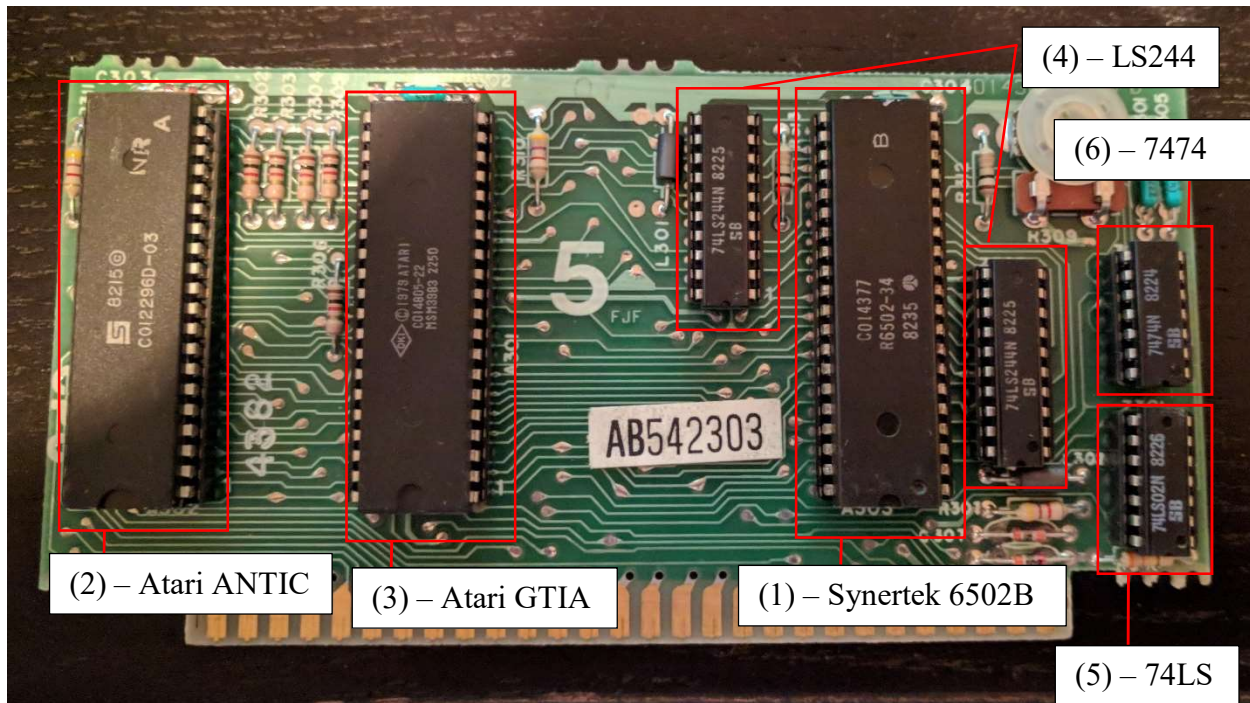
This is the 800's processing card. It has:

1. Synertek 6502B – Essentially a MOS Technologies 6502, the legendary CPU that powered many early computers, including the Apple II, Commodore 64, and others. It is an 8-bit CPU running at 2 MHz
2. Atari ANTIC – The ANTIC, or Alphanumeric Television Interface Controller, is one of the Atari's two graphics chips. It is responsible for rendering text on the screen, as well as background images in games.
3. Atari GTIA – The GTIA generates the Atari's sprites for games, and colorizes the background graphics passed to it by the ANTIC. It also generates the clicks that come out of the speaker with every keypress.
4. LS244 – RAM buffer
5. 74LS – CPU support chip, adding a HALT function that is not supported by standard 6502 CPU instruction set.
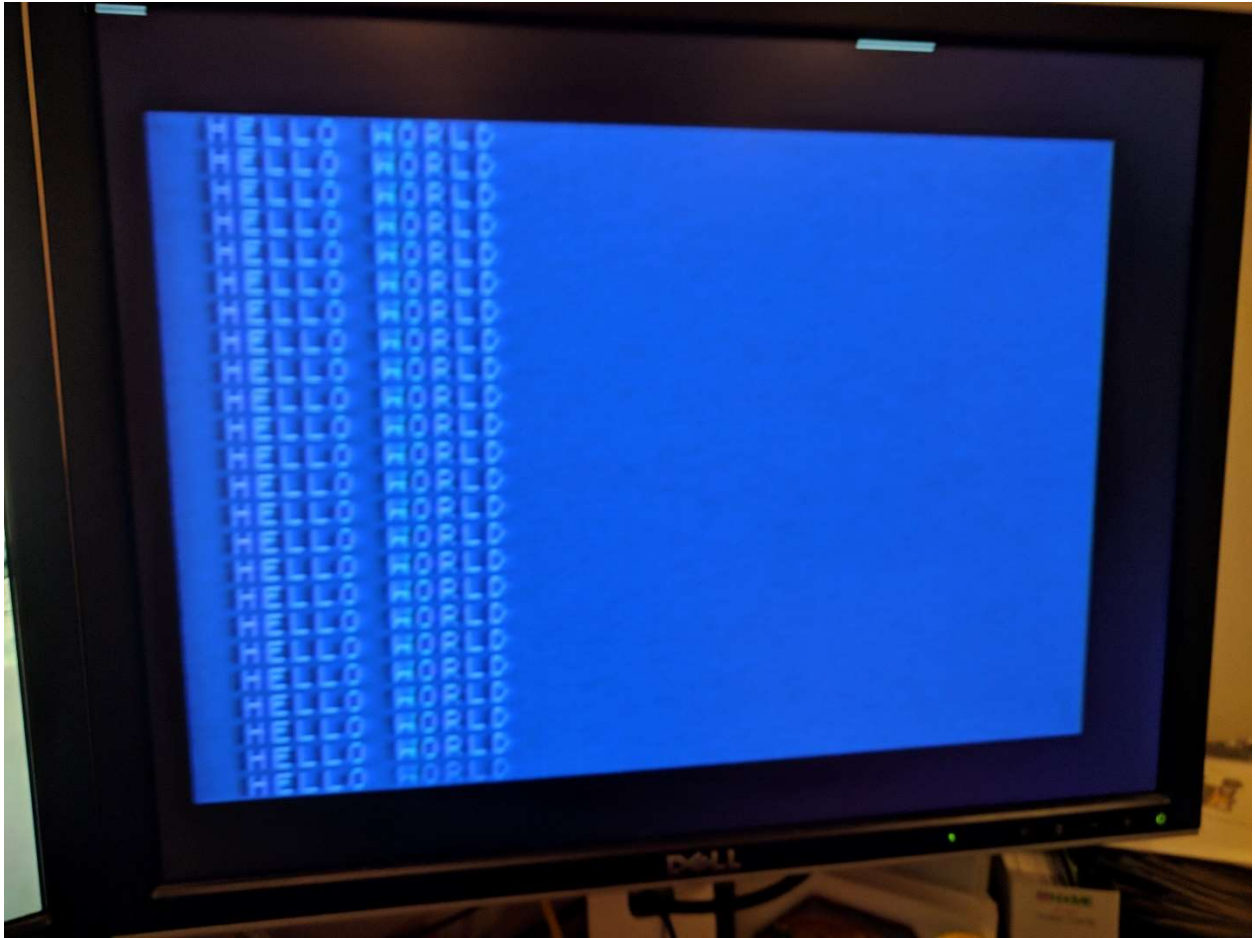6. 7474 – Another CPU support chip, again to add HALT functionality.
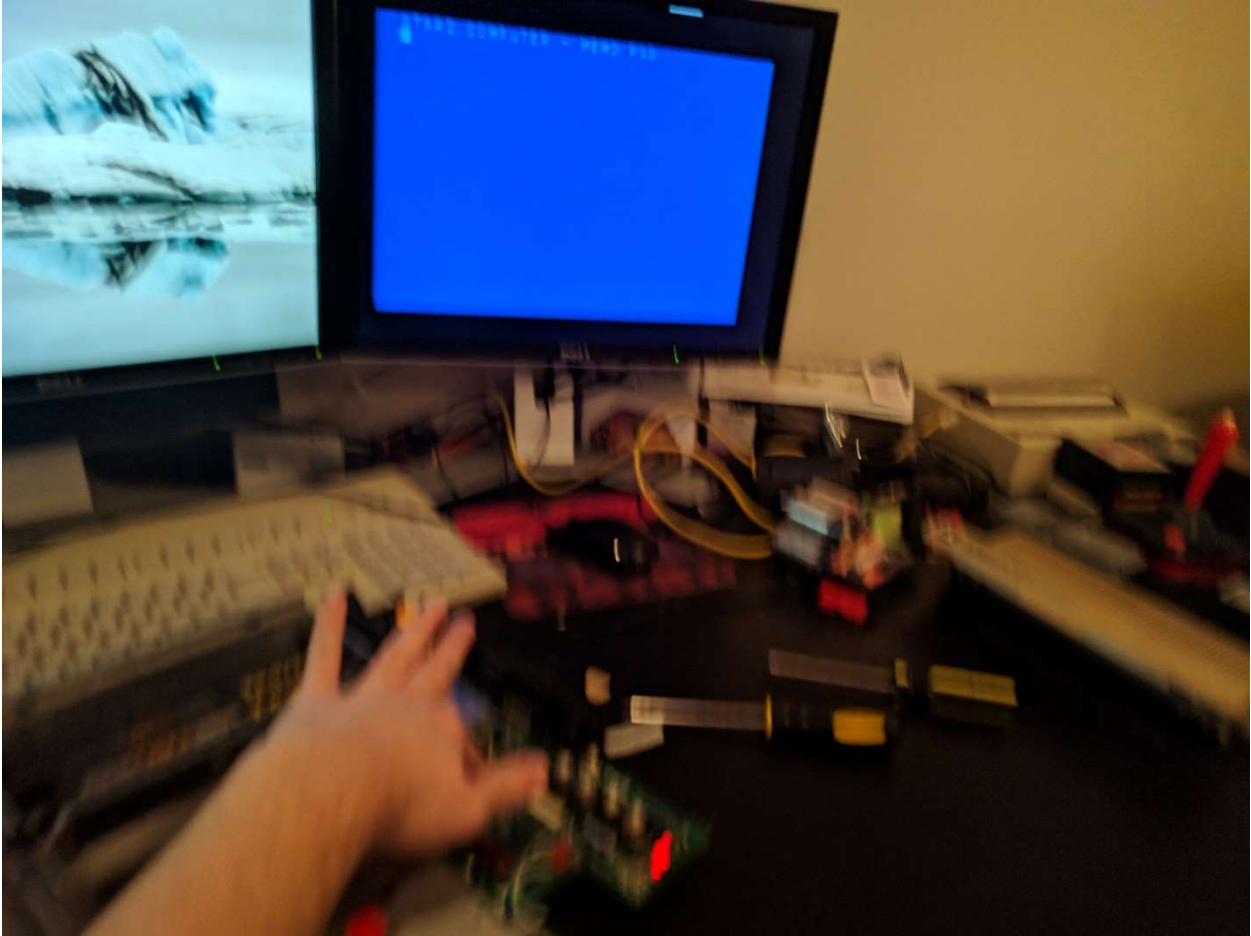
It's alive! Just a quick power-on test before putting the computer back together. Sorry for the blurry picture, I had trouble holding the camera still with one hand while holding a button on the motherboard.
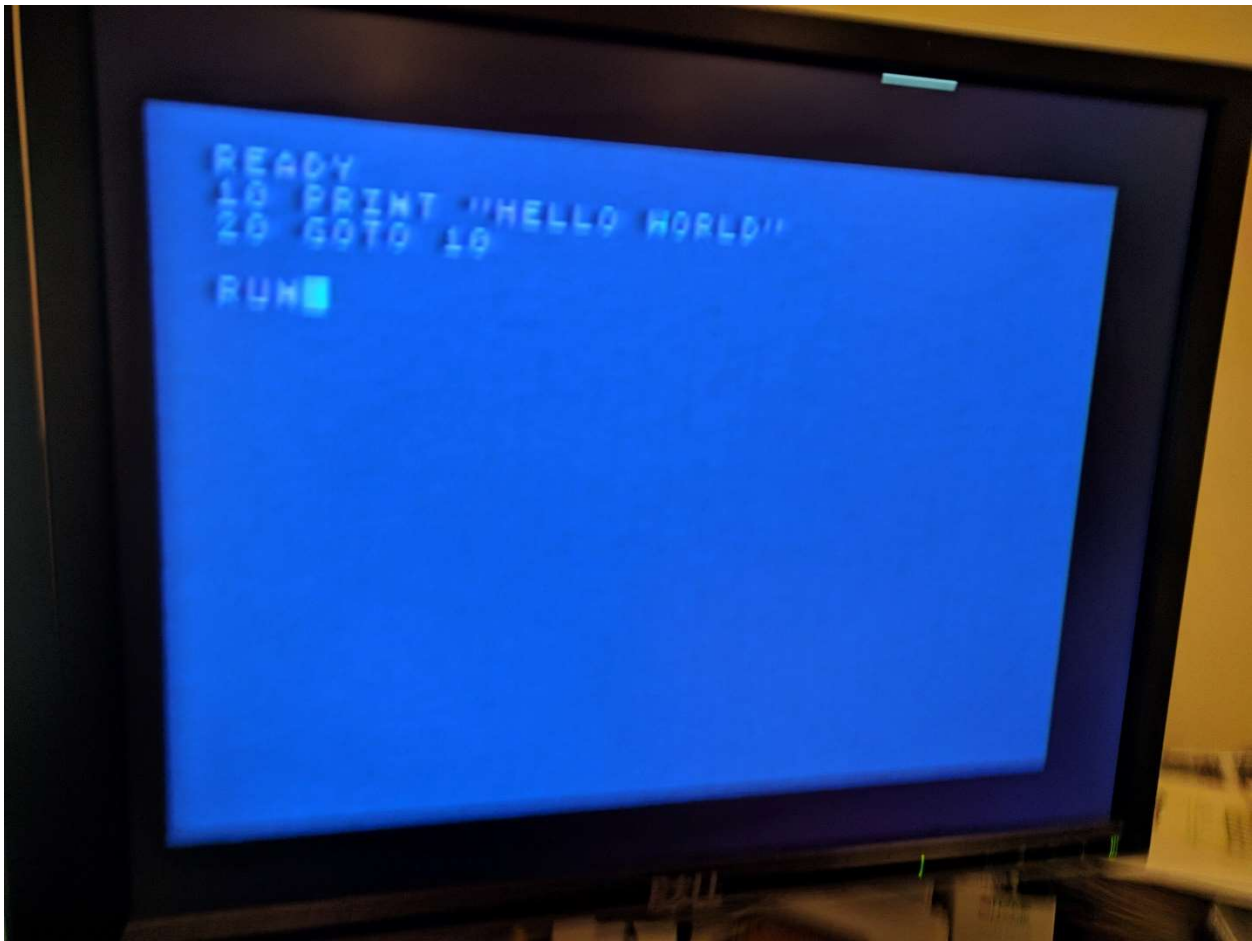
Anyone who has used a computer with BASIC will recognize this one…

Yay!

Conclusion

Although the Atari 800 is now 40 years old, it is a piece of magnificent engineering. From the creative tricks allowing the POKEY to serve many purposes at the same time, to the support chips enabling HALT on the 6502, it is clear that every aspect of the computer has been thought out and planned.

The build quality of the hardware was incredible. Every solder joint was carefully and perfectly hand-soldered, and the computer was manufactured in the USA. All parts of the design of the hardware and the execution of the final product show the clear love and attention to detail the people at Atari had toward the 800. Although the Atari 800 is an antique, it is no surprise that this one is still working perfectly.

We hope that we can have this same love and attention to detail towards our robot. We try to think out our strategy and are careful not to take shortcuts with our build. Although we have had mishaps and missteps, we learn from them to show up at the next competition, and are better able to compete.

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