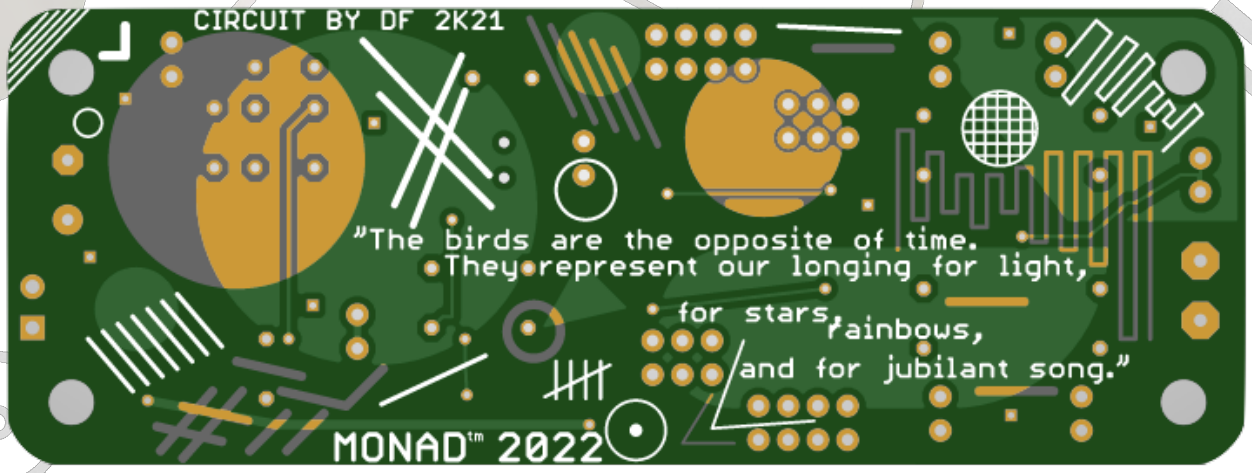
MONAD

WOODCOCK



MONAD001: WOODCOCK – DANIEL FISHKIN

WOODCOCK is a modular bird synthesizer, simulating calls of the marshland Woodcock, powered by a solar-panel and sounded through a loudspeaker. Program the melodies of your bird brain with jumper cables, and define the pitch of its song with careful capacitor choice.

WOODCOCK has a complex bird brain, and limited bird throat—it can only make four notes, yet you, *the Creator*, can organize these notes into long patterns which will be further complicated by weather conditions in its environment. The Bird Brain is influenced by four different bodyclocks—bird heartbeat, bird reproductive clock, bird stomach, and chaos variable. Solder four capacitors, **SET** / **IT** / **OFF** / **XTRA**, to define these four clocks. Solder 3 identical HORN capacitors to set the base pitch of the Bird's throat. Solder three CONDU caps to define the smartness of the bird brain—how fast it thinks.

Solder **JUMPER** connectors to allow repatchable birdsongs to commence. Patch Clocks to the inputs of the bird's two Shift Registers to define the bird behavior. Patch Shift Register Outputs to **RHY** to clock the base throat pitch, and then patch additional outputs to **BRANE** and **BRAIN** to define the contours of the four-note song. Once you select the song you like, you can "hard-code" the jumper pattern by soldering below to the jumper's adjacent row. Wire up a solar panel to allow these circuits to interact with Nature's life-force, the sun's warming rays. Wire up a speaker so **BIRDSONG** can impact the world and your ears.

WOODCOCK is an intermediate circuit for Solder Soldiers (beginners should start with another circuit!)—most of the nervous system and musculature of the WOODCOCK are miniaturized, surface-mount components that have been pre-soldered by Robots in China. All you need is 11 capacitors, 11 sets of jumpers, a bundle of jumper wires, 1 solar panel and 1 speaker to start making music.

This circuit composition was developed in 2021 by Daniel Fishkin. This circuit extends the wonderful "Mourning Dove" Bird Circuit by Peter Blasser by adding more notes to the bird song. if you're curious about building more solar sounders, please check his wonderful article here: https://econtact.ca/18_3/blasser_solarsounder.html

BUILD NOTES:

PARTZ LIZT:

Mouser Cart:
https://www.mouser.com/ProjectManager/ProjectDetail.aspx?AccessID=516512951a

If you have no components, you can buy this cart at mouser! This cart supplies you with enough parts to build three woodcoxen. If you have a bundle of components at home, you might still like to buy some nice components from this website, to replace your decaying old stash of electrolytics and ceramics. Definitely get the headers, they're good!

Speaker:
Any works! Here are few we like at MONAD:

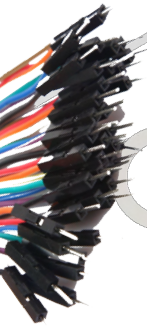
https://www.parts-express.com/Visaton-FR7-4-2-1-2-Full-Range-Driver-4-Ohm-292-638https://www.parts-express.com/Visaton-FR10-8-4-Full-Range-Speaker-292-513 https://www.parts-express.com/Visaton-R10SC-4-4-Fullrange-Speaker-4-Ohm-292-602 https://www.parts-express.com/Visaton-FX10-4-Coaxial-Speaker-292-674

You can of course, use whatever!

Solar Panel:
Solar Panels are available from multifarious sellers. This is the juice that makes your circuit go—different panels will produce different results. 9 Volts 3 Watts is the best starter panel to use—look on on ebay or amazon!
300ma is the golden number, but if you have two 200ma panels, you can wire them in parallel for higher capacitor solar panel.

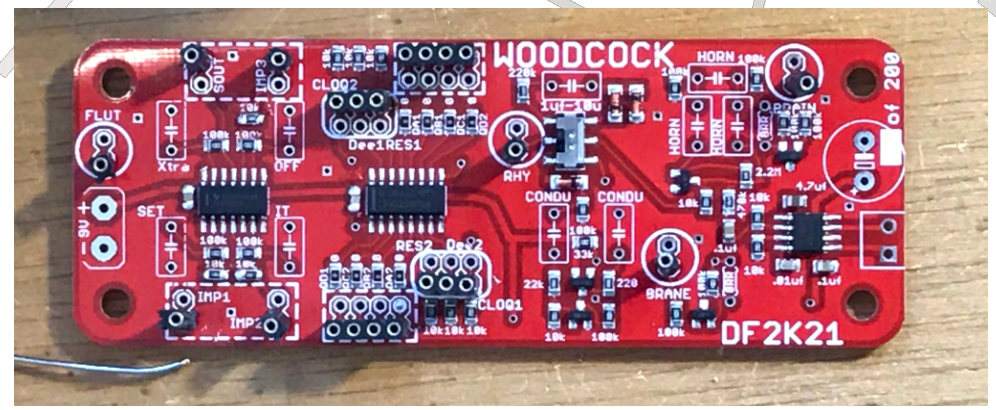
https://voltaicsystems.com/2-watt-panel/ These work beautiful but are expensive. (You need to wire them in series to get 12v)

Hookup wire:
You know what really ruins DIY kits? Shitty wire. Your shit breaks in the middle of testing and kills the mood. https://www.mcmaster.com/9564T3 We love this fancy wire at MONAD. You can strip it with your fingernail, and it has so many strands inside that it's unlikely to break when you're throwing around your solar panel and speaker.
Jumper wires: This is really ubiquitous stuff—you can find them called "dupont" jumpers, and they're everywhere! Actually, these wires are quite often shitty but it can be excused because you need to test configurations rather quickly.



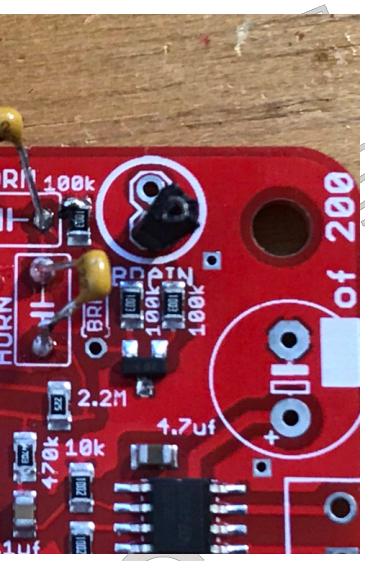
Box:
Get creative! See http://dfiction.com/solar-sounders/ for ideas... and keep in mind: This circuit will be much louder when you enclose its speaker in a hollow cavity!

Begin:



Once you have collected all the requisite parts, start by soldering the pin headers for connections in the various elements of the bird brain.
If you're using the **MONAD BOM**, the headers are really nice with little springs inside (good for patching!).

For the 4x and 3x headers, you don't need to trim any strip sockets. But for the singleton headers, you should carefully slice the 8 row jumpers off with a diagonal cutters one by one. For the headers, cut your strip to length (2, 3 and 4) and solder them parallel to the length of the board leaving a strip of bare pins open. (we leave the adjacent sockets open for hardcoding the favorite patch with solder at the end of your flight of fancy.) It's easy to solder the jumpers first since everything is the same height. Use telekinesis to hold the singleton jumpers in place or perhaps a piece of masking tape.



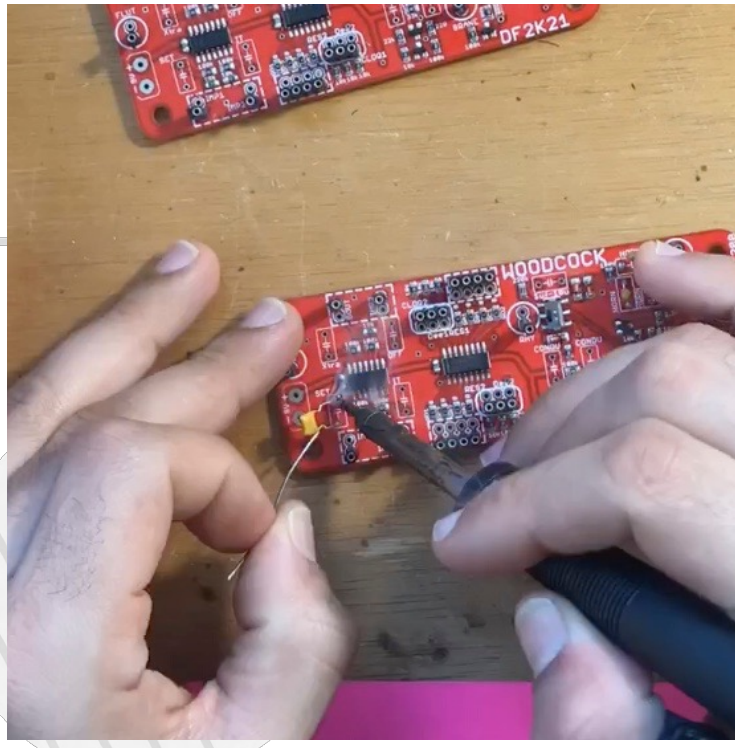
Pitch Selection:
Once you have this assembled, you can move on to the musically significant component selection. Starting from the speaker side of the board, note the HORN capacitors. The value of these capacitors (all the same) will determine the pitch range of the bird voice. Aim for somewhere in the .001 — .0047 uf range, (usually coded as 102-472 capacitor code) but experiment as desired. These capacitors are the resonant basis of a phase-shift oscillator, which is the bird's voice. Depending on the setting of the CONDU caps, this oscillator is relatively pitch-stable in sunlight. If you plan to try different values, leave long legs on the components so that you can easily clip them off the board and resolder to the extended legs.

For tuning multiple birds: the pitch capacitors in your MONAD BOM give 6 possible base frequencies. the ratio of 3:2 in these capacitor choices results in a perfect fifth, for example 1.5 nf and 1 nf are a perfect fifth apart.

Keep the capacitors identical, or bravely risk shifting the resonant network of the Woodcock.

You can also add an extra resistor (474k—50k) in the BRR sockets if you want to change the intervals of the woodcock throat, but this is an easter-egg meant for your discovery, and henceforth will never be mentioned again!

Reminder, in this house, we prefer to solder from the top, not the bottom!



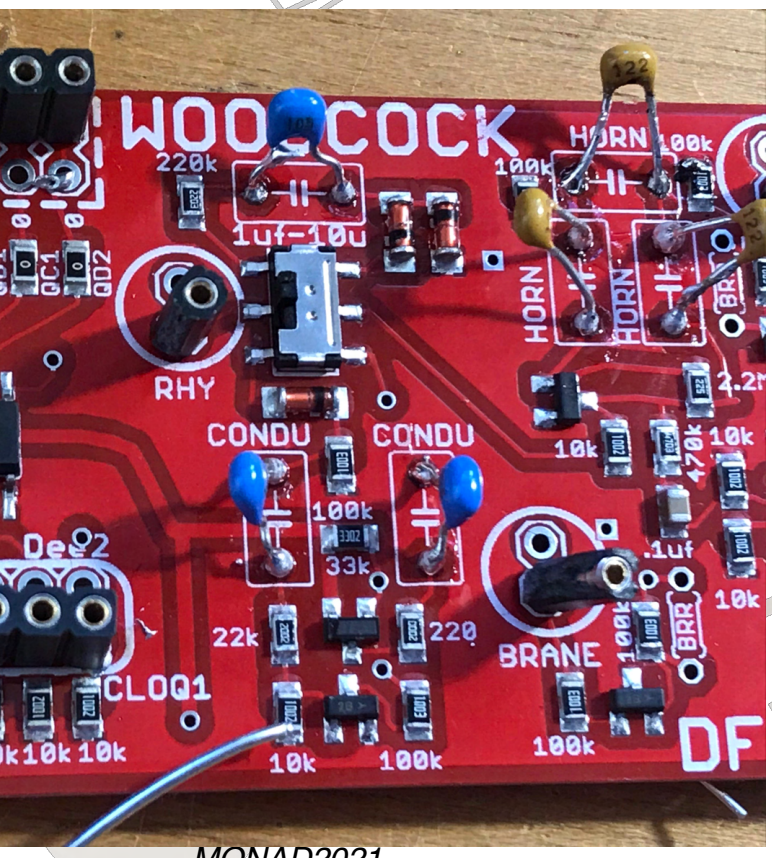
Interlude: Capacitor Customization:

You can make custom capacitors by wiring caps in an embrace (parallel) or holding hands (series).

Capacitors in parallel get bigger—ie, C1||C2||C3 = Ctotal = C1+C2+C3

Capacitors in series get smaller, ie C1→C2→C3 = Ctotal =1/((1/C1)+(1/C2)+(1/C3))

Blah blah blah. You've heard this a hundred times before but are still confused. Simple: identical capacitors in parallel DOUBLE in size, identical caps in series HALF in size. Ok? (Did you notice how capacitor series/parallel logic is inverse from resistors?)



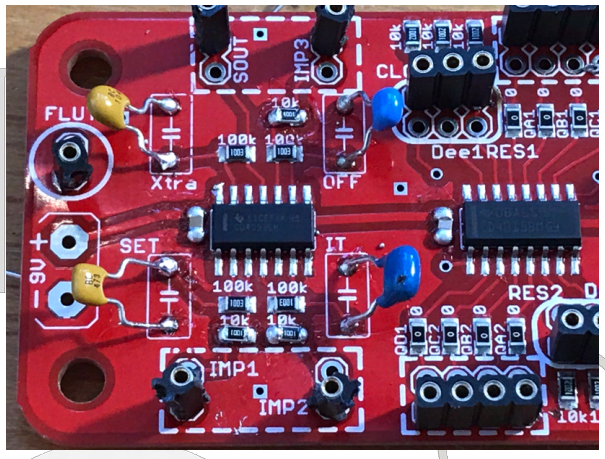
Note Length:

Next, the CONDU capacitors will determine the length and decay of syllables. In the top position, the silkscreen legend suggests you try 1uf-10. Try .47uf or 1 uf first. You can always wire another capacitor in parallel to build a larger composite capacitor. Now, for the bottom two capacitors, try 6.8uf and 4.7uf.

The switch in the upward position activates the top decay network, the switch in the bottom setting activates the bottom decay network. Note: the bottom decay network preserves the pitch configuration of the Bird Throat.

Some patches will work better with switch up, some better down! Try switching back and forth to hear two different expressions of the bird voice: songful and percussive.

RHYTHMS:

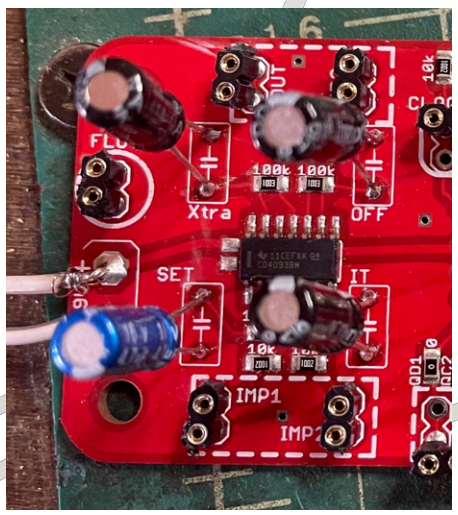


Turn your attention to the **SET IF OFF XTRA** capacitors. These are classic logic oscillators, called NAND gates. (Thanks Nic Collins!). These oscillators will behave very differently in all light conditions, creating rhythmic variety for our Bird Brain. **SET**, **IT**, **OFF** are wired as simple square-wave oscillators. XTRA is a gated oscillator which can take an additional input. The value of these capacitors determine the rate of four oscillations in the bird brain that you'll use to control it's voice.

You will want to pick 4 different capacitor values; larger capacitors will result in slower oscillations. You might succeed in slowing down faster capacitor oscillators later, by using the shift register when you are patching! and If something sounds off, feel free to tack on another capacitor in parallel (slow it down). True wizards can parallel the SMT 100k resistors to (speed it up)!

Some possible combinations to start out with:

SET	/	IT	/	OFF	/	XTRA
.47 uf	/	.1 uf	/	1.5 uf	/	.1 uf
.01 uf	/	.22 uf	/	.1 uf	/	1 uf
.047 uf	/	10 uf	/	15 uf	/	.1 uf



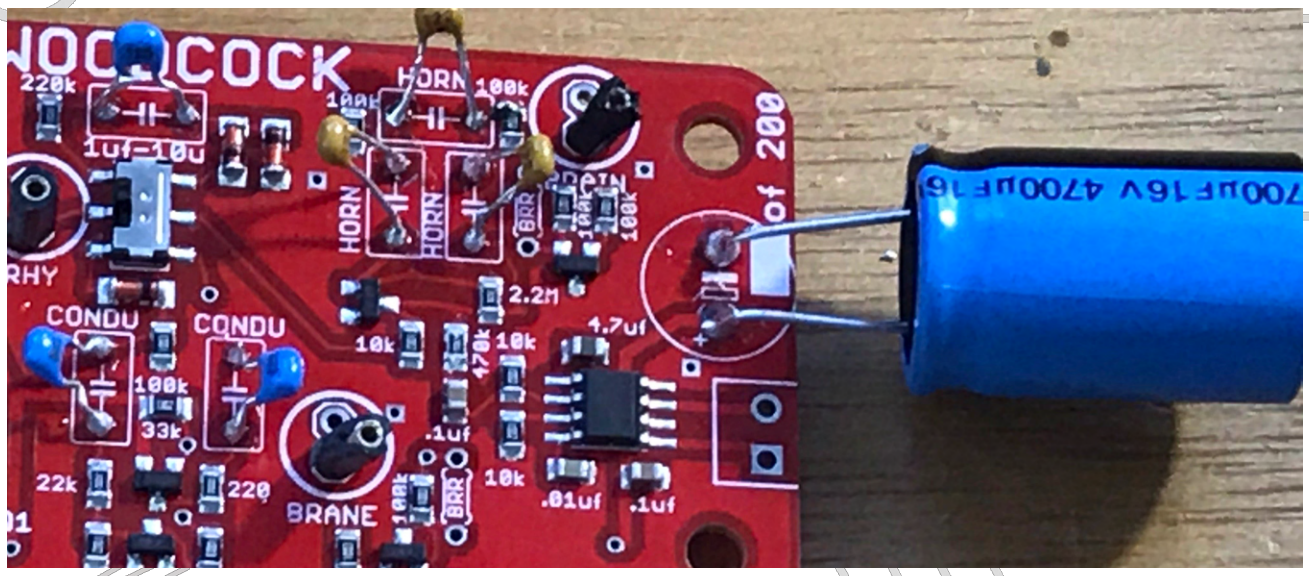
Leave long legs to allow easier swapping later. If you're using the MONAD BOM, you have nonpolar capacitors, which can go either way :D !

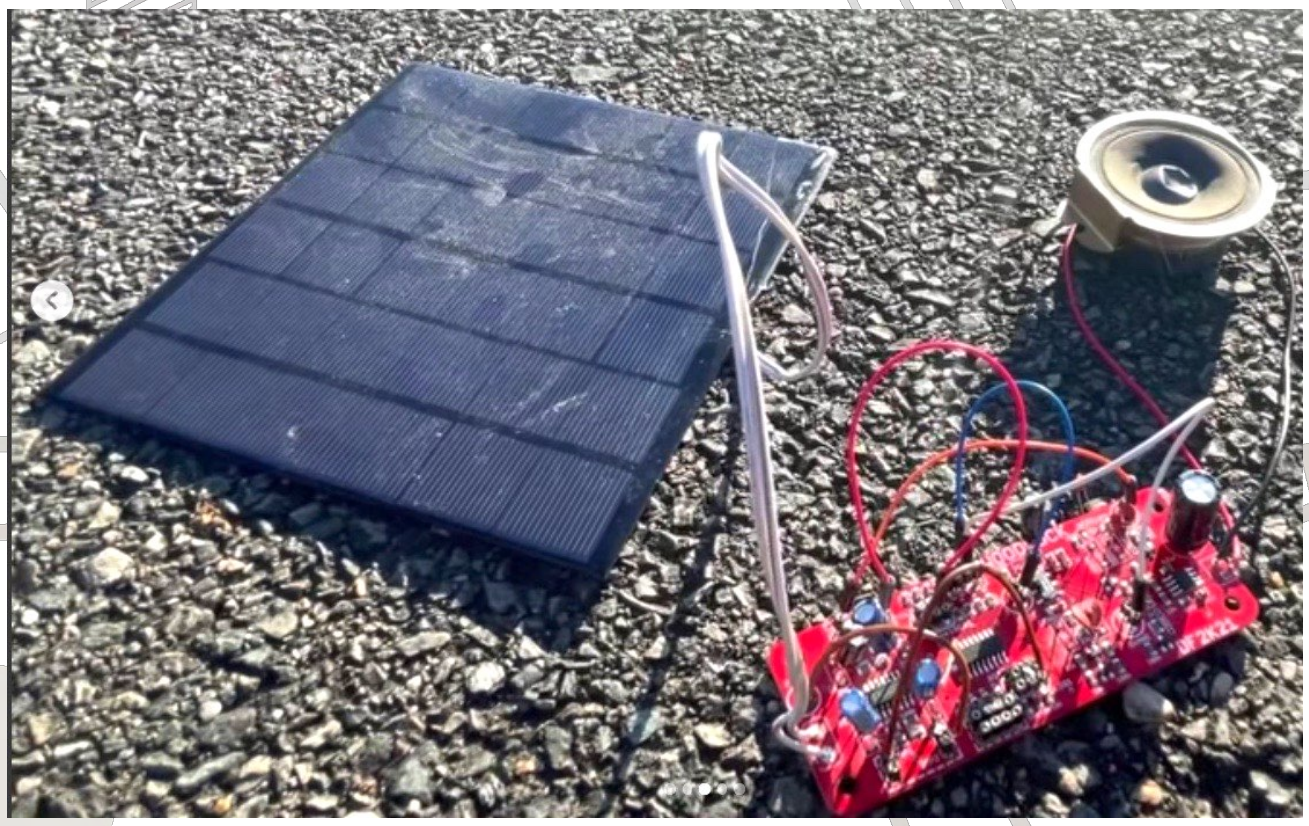
If you are using polarized capacitors, the environment hates you, your circuit maligns your imprecision and entropy, and you'll need to pay close attention to where the negative lead is supposed to go. SET, OFF and XTRA capacitors will have their negative lead facing OUT, toward the edge of the board. IT capacitor will have its negative lead facing IN.

You will discover something new with each new capacitor configuration, just keep swapping, testing and listening. No right answers, only different flavors.

Next, Connect the speaker and solar panel.
Warning! Be sure to pay close attention to the polarity of the power leads or you will destroy your circuit before you get to have any fun—don't fuck this up!
Speaker polarity is indicated but doesn't really matter!

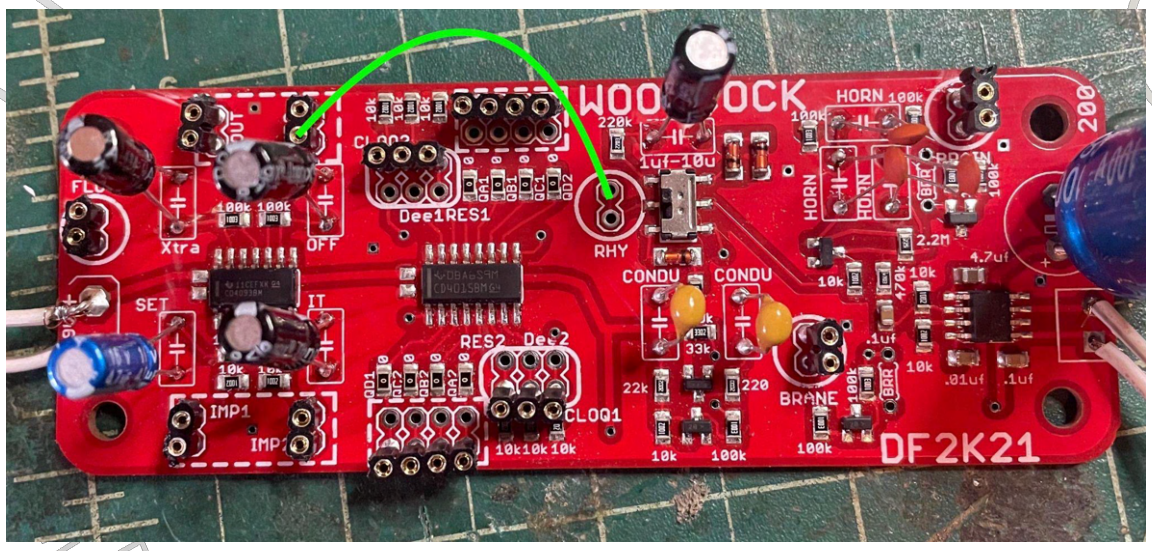
You can now solder in the large capacitor at the end of the board —but make sure you let the leads go long and bend the capacitor down axially—in case you want to substitute the value later.





PATCHING:

Now that you have preliminary components soldered into the board, it is time to test. We test by patching inputs to outputs. On Woodcock, outputs are squares marked with a dashed-line. Inputs are circles marked with a solid line.
Using one of the dupont cables, patch from one of your oscillators [the jumper terminals on the left half of the board enclosed by dotted lines] to the bird voice control input [the encircled jumper terminal labeled RHY]. You should hear a continuously repeating call out of the speaker. Try patching the other oscillators into this input to hear their speed.



A note on the XTRA oscillator and the FLUT input: XTRA oscillator is a NAND oscillator with FLUT as the inhibitory input. Meaning you can patch an oscillator or other signal into FLUT to get more complex gated rhythms and oscillations. Be careful tho! If nothing is connected to FLUT, XTRA output will behave erratically.

[Note, if you've picked RHYTHM capacitors smaller than 1uf, you might not hear them fluttering the rhythms, since the condu length is long, depending on how you configure it, by switch or by cap.]

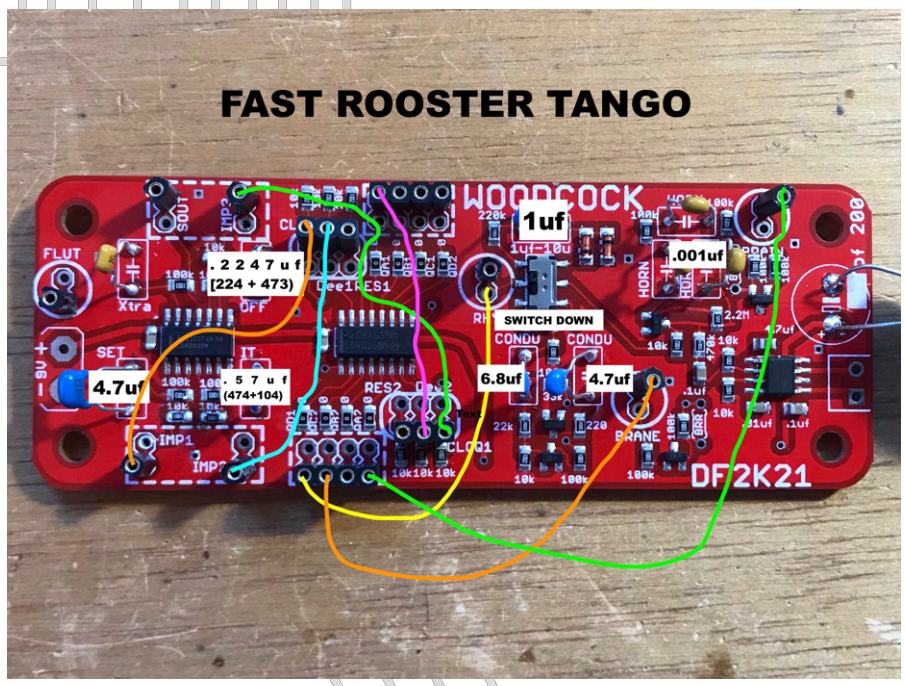
Now testing is done. So we turn to musical patch configurations. But it's time to go into the Sunlight! Step outside to test the rest of your patches.

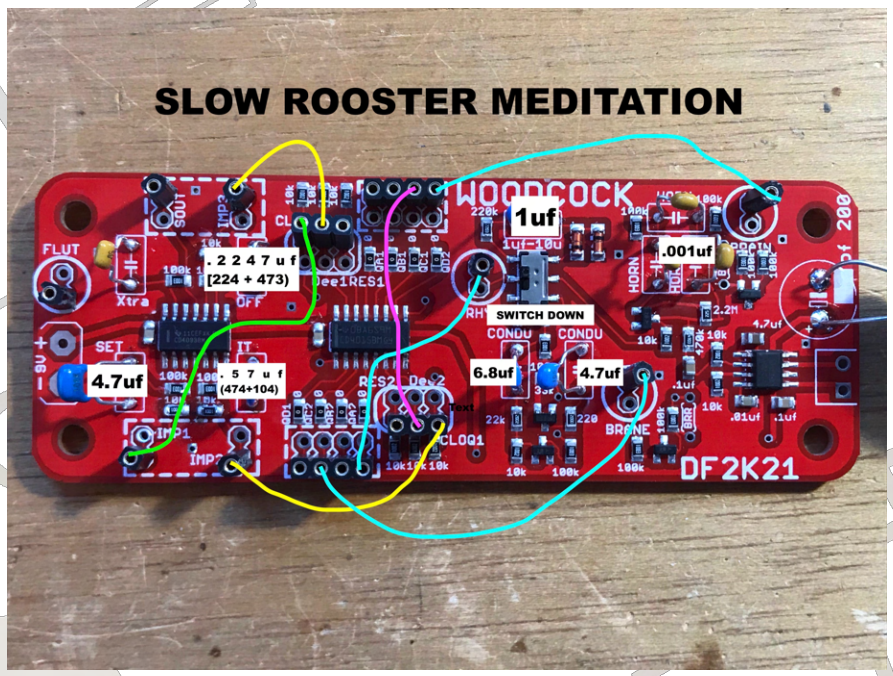
We will be using the center processing and associative layer of the bird brain in the middle of the board to create longer more complex patterns in the bird voice. Patch one of SET/IT/OFF/XTRA into the jumper CLOQ1 and another into Dee1. This will result in four neural signals being output from the processing center (labeled QA1, QB1, QC1, QD1) for output into the bird voice control or for folding back into other parts of the brain.

WOODCOCK SONGBOOK

FAST ROOSTER TANGO

SET (4.7uf)	→	CLOQ2
IT (.57uf [474 + 104])	→	Dee1
OFF (.2247uf [224 + 473)]	→	CLOQ1
QD1	→	RHY
QB1	→	CLOQ2
QA1	→	Dee2
QC2	→	BRAIN
QA2	→	BRANE
1u—10uf	=	1 uf
CONDU left	=	6.8 uf
CONDU right	=	4.7 uf
HORN	=	.001 uf
SWITCH: DOWN		



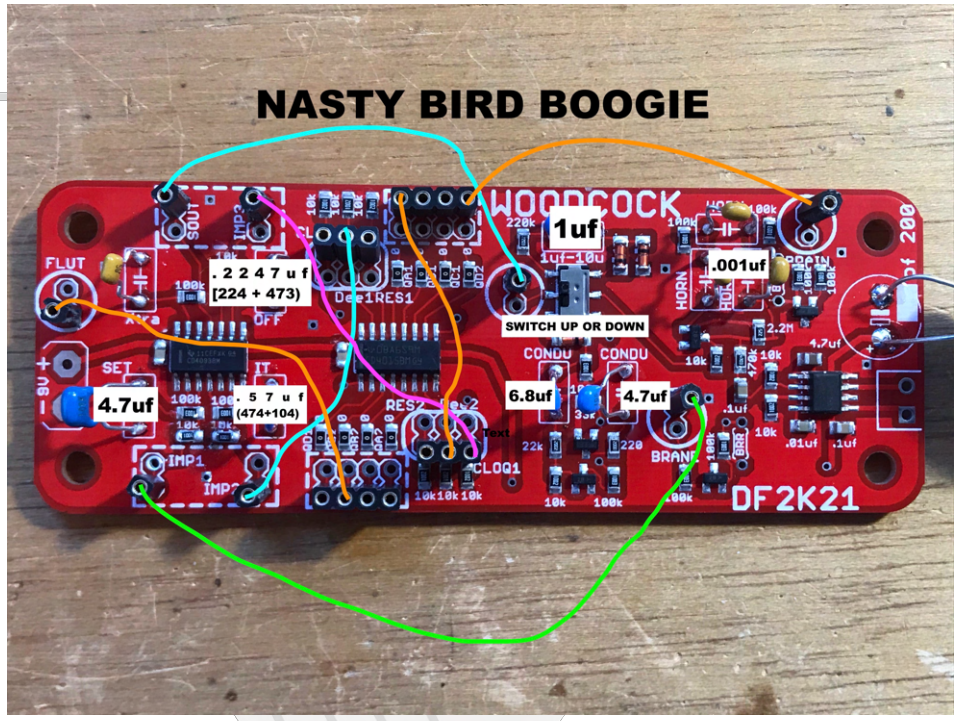


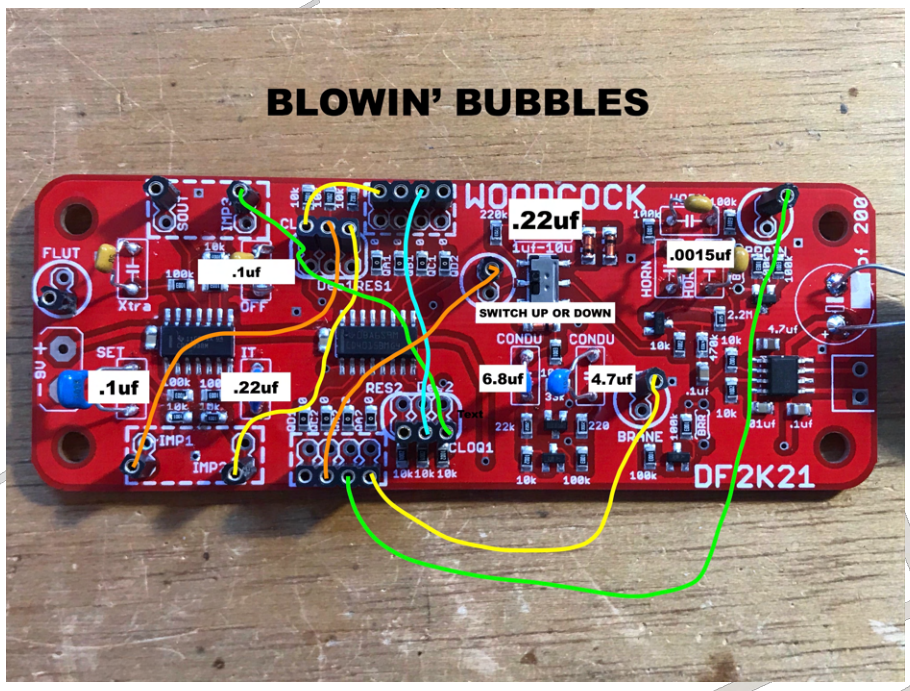
SLOW ROOSTER MEDITATION

SET (4.7uf)	→	CLOQ2
IT (.57uf [474 + 104])	→	CLOQ1
OFF (.2247uf	→	DEE1
QA2	→	RHY
QC1	→	Dee2
QC2	→	BRAIN
QD2	→	BRANE
1u—10uf	=	1 uf
CONDU left	=	6.8 uf
CONDU right	=	4.7 uf
HORN	=	.001 uf
SWITCH: DOWN		

NASTY BIRD BOOGIE

SET (4.7uf)	→	BRANE
IT (.57uf [474 + 104])	→	DEE1
OFF (.2247uf]	→	CLOQ1
SOUT	→	RHY
QC2	→	FLUT
QA1	→	Dee2
QD1	→	CLOQ2
QD2	→	BRAIN
1u—10uf	=	1 uf
CONDU left	=	6.8 uf
CONDU right	=	4.7 uf
HORN	= .	001 uf
SWITCH: UP OR DOWN		





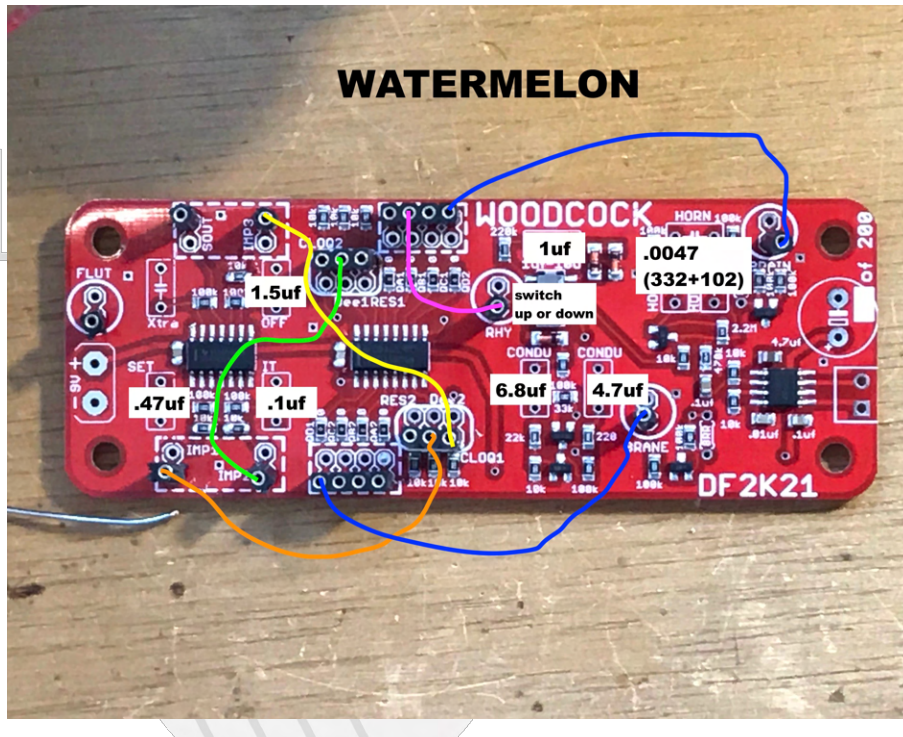
Blowin' Bubbles

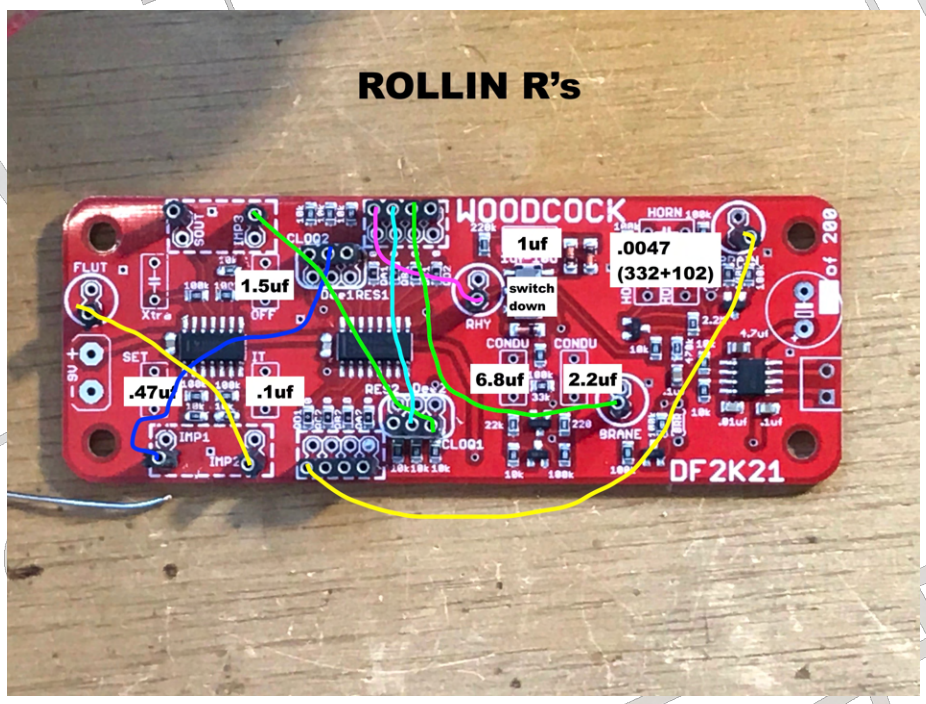
SET (.01uf)	→	DEE1
IT (.22uf)	→	RES1
OFF (.1uf)	→	CLOQ1
QC1	→	Dee2
QA1	→	CLOQ2
QA2	→	BRANE
QB2	→	BRAIN
QC2	→	RHY
1u—10uf	=	.22 uf
CONDU left	=	6.8 uf
CONDU right	=	4.7 uf
HORN	=	.0015 uf
SWITCH: DOWN		

WATERMELON

SET (.47uf)	→	Dee2
IT (.1uf)	→	DEE1
OFF (1.5 uf)	→	CLOQ1
QB1	→	CLOQ2
QB2	→	RHY
QD1	→	BRANE
QD2	→	BRAIN
1u—10uf	=	1 uf
CONDU left	=	6.8 uf
CONDU right	=	4.7 uf
HORN	=	.0047 uf (actually used 332+102)

SWITCH: UP OR DOWN

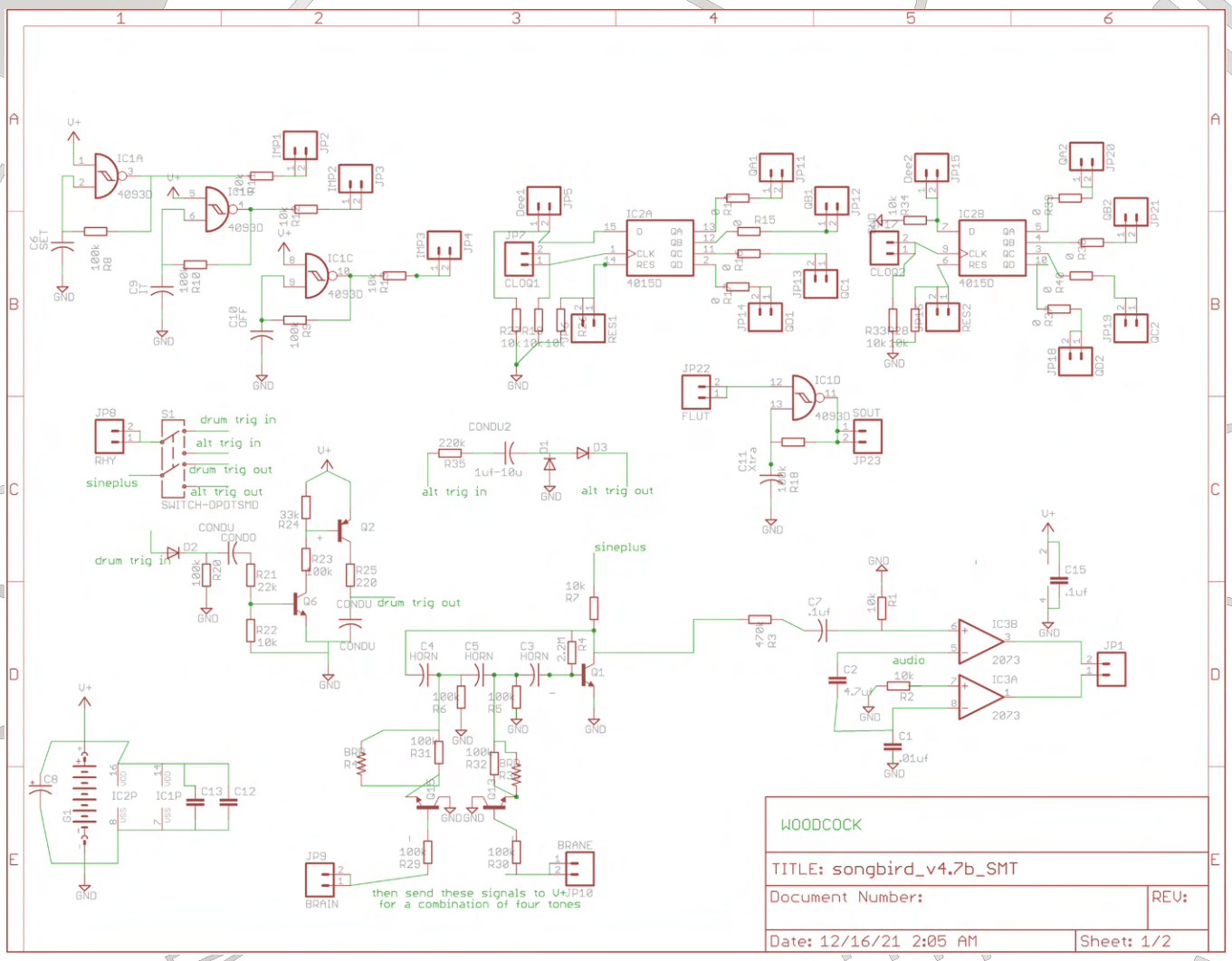




ROLLIN' R'S

SET (.047 uf)	→	Dee1
IT (10 uf)	→	FLUT
OFF (15 uf)	→	CLOQ1
XTRA (.1 uf)	→	CLOQ2
QA1	→	RHY
QB1	→	Dee2
QC1	→	BRANE
QD1	→	BRAIN
1u—10uf	=	1 uf
CONDU left	=	6.8 uf
CONDU right	=	2.2 uf
HORN	=	.0027 uf

SWITCH: DOWN



Schematic

Here's the schematic. This circuit integrates a lot of different ideas over the year that inspired me along the way. The original idea of using a phase shift oscillator powered by variable solar supply is indebted to Peter Blasser—thanks Peter for your endless inspiration! Here's another riff on your dove. Anything you throw at that 3C2R circuit will change the overall resonance! (you can also change those 100k resistors to get the circuit hooting a little louder). Thanks Martin Freeman for teaching me about shift registers. Trigger circuitry for Bird Calls were derived from the Roland 808 gate pulses, which I found by looking at the scheme for Eric Archer's mini-space rockers—the other pulse circuit is an original riff on "Mickey Mouse Logic". Of course, thanks to Nic Collins for popularizing the magic of the 4093 NAND Gate. Feels a little lame to use it, but the schmitt trigger is good at resisting re-triggering—important for slow square waves and solar panels.