## **Caveatron SV Bill of Materials Hardware Revision: C**

Date: 2023-02-20

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Main Processor	1	PJRC Electronics	Teensy 4.1	Teensy 4.1	PJRC Store	
Notes: The ma	in systen	n processor. Availa	ble from multiple	e vendors. Versions with	and without the pins pro	e-installed are available (link above is with pins).

Either of the ve	rsions (	with or without Eth	ernet) are fine.			
Touchscreen LCD	1	BuyDisplay	N/A	LCD 3.5" 320x480 TFT Display Module, OPTL Touch Screen w/Breakout Board  Options: -Capacitive touch panel -16-bit 8080 40-pin header -3.3V supply -No font chip	<u>BuyDisplay</u>	Workspace  Social Vibes Survivinity Surviv

**Notes:** The display and user interface. Note that this is the capacitive touchscreen version unlike the resistive version used previously.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Laser Rangefinder  OPTION 1	1	JRT Meter Tech., Co, Ltd.	Unknown	40m – 60m Laser Distance Sensor Module	Ebay Ebay Ebay Ebay Alibaba Alibaba Alibaba Alibaba Availability changes frequently. Sites linked above has availability as of the date of this BOM	
				ats of this module including those nink any variant of this style shou		EX-based commands both of which are
Font/Graphics IC	1	Winbond	W25Q128JVSIM	W25Q128 SPI flash memory IC, 128 Mbit, quad 8-SOIC	Digikey and many other source	STATE OF STA

**Notes:** Contains the fonts and graphics used for the GUI. You must use the 128Mbit 8-SOIC package version – other sizes may not work. It is soldered to the pad location on the underside of the Teensy 4.1 that is directly under the micro-SD slot and closest to the edge.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Compass Module  OPTIONAL BUT HIGHLY RECOMMENED	1	Witmotion	RM3100	WitMotion High-Precision RM3100 Military-grade Magnetometer Sensor	Amazon or Witmotion	

**Notes:** *Used to determine the azimuth angle of the Caveatron.* This is the best currently available low-cost magnetometer module option. This magnetometer has proven more accurate, reliable and with less drift than another other tested. It is optional since the Pololu IMU module below also includes a magnetometer but the Pololu magnetometer is much more noisy and less accurate, so it is highly recommended that you use this module.

IMU Module	1	Pololu	MinIMU-9 v5 (#2738)	MinIMU-9 v5 Gyro, Accelerometer, Compass (LSM6DS33, and LIS3MDL Carrier)	<u>Pololu</u>	

**Notes:** *Used to determine orientation of the Caveatron and measure inclination.* Note that the AltIMU-10 v5 does not fit on the current PCB. The MinIMU-9 v3 and v4 are still supported by the code and electronics but are no longer available.

Item	Qty	Manufacture r	Mfr. P/N	Description	Suggested Vendor Link	Photo			
Battery Charger Module	1	Unknown	TP5000	Lithium Ion 3.7V Charger Module	Amazon	102 100 00 00 00 00 00 00 00 00 00 00 00 00			
<b>Notes:</b> <i>Battery charging module.</i> There are several sources for this module and at least 2 variants. Be sure to get the variant with the 4 power pins all on the same side. A solder bridge is required to make it functional and a 0.2 ohm resistor can be added to increase the charge current above 1 Amp. These are usually on a red PCB but can also be green from other sources.									
10k resistor	2	Various	Various	SMD resistor, 10k-ohm, 1%, 1206 package	<u>Digikey</u>				
				l d for IMU power input. Avail	able from numer	ous manufacturers and vendors - the above is only 1 example. 1/4 watt or			
3.3k resistor	1	arries no significar Various	Various	SMD resistor, 3.3k-ohm, 1%, 1206 package	Digikey				
Notes: Resistor			ge divider. Av	vailable from numerous manu	ifacturers and ver	ndors - the above is only 1 example. 1/4 watt or less is fine since this			

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Battery Pack OPTION 1	1	Dantona	L37A26-1-0- 2WX	18650 Lithium-Ion Battery Rechargeable (Secondary) 2.6Ah	<u>Digikey</u>	COLUMN STATE OF THE STATE OF TH
Notes: Primary Battery Pack OPTION 2	y system 1	Adafruit Adafruit	on comes with a	2-pin JST connector. A s  Lithium Ion Cylindrical Battery - 3.7v 2200mAh	imilar battery is availab  Adafruit	le from Tenergy (PN 30011) but is not connectorized: Tenergy
Notes: Primary	y system	battery. This option	on is a lower capa	acity battery but might be	an option if you are una	able to obtain the higher capacity option above.
Voltage Regulator – 5V	1	Pololu		V Step-Up/Step-Down tage Regulator S7V7F5	<u>Pololu</u>	EX-LIPS OF TOTAL OF THE PARTY O
Notes: Power s	supply fe	or Teensy.	•			
LRF Voltage Regulator	1	Pololu		ololu Adjustable Step- p/Step-Down Voltage Regulator S7V8A	<u>Pololu</u>	
Notes: Power s	supply fo	or Laser Rangefind	er. Output needs	to be set to 3.0V.		

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Power Switch Module	1	Pololu	2808	Mini Pushbutton Power Switch with Reverse Voltage Protection, LV	<u>Pololu</u>	
Notes: Turns o	n and o	ff system power whe	en pushbutton j	power switch is pressed and also con	trols timed auto p	power-off.
RTC Battery Holder	1	MPD and others	BC501SM	Coin Cell Battery Holder - 12mm (for CR1220 batteries)	<u>Digikey</u> <u>Amazon</u>	
						ers are available from many sources with differing part
Piezoelectric Buzzer	1	Uxcell	surface mount A1406240 Oux0199	all have nearly identical dimensions uxcell A14062400ux0199 5 Pcs DC 2-28V 80Db Sound Electronic Passive Buzzer Alarm Black, 22 x 4.5 mm	so should work.  Amazon	
Notes: Indicate	or buzze	<i>r</i> .				

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Power Switch & Charging LED	1	Adafruit	3350	Rugged Metal Pushbutton - 16mm 6V RGB Momentary	Adafruit  Amazon	

**Notes:** On/Off power switch and charge indicating ring LED. This one enables separate colors on the ring LED for indicating charging and charge complete. These can be found at other sources as well but if you buy from another source be sure to get the common anode version.

Tourier at other s	to said at outer sources as well out if you out from another source of said to get the common another version.										
USB Jack	1	GT Contact	GT114200-10 (RR-114200-10)	Mini USB-B C2 size Plastic Panel Mount	USBFirewire.						
						www.U.S.B.Fire.Wire					
						GIG					

**Notes:** *USB jack for data download, battery charging, and loading of software and calibration parameters.* This is the version with the solder pins on the inside. If you prefer a USB-micro connector, that is available as part number RR-11A200-10 and is an identical fit.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
USB Cap	1	GT Contact	GT1C522122 (RR-1C522122)	Seal Cap	USBFirewire. com	SBFireWire.com

Notes: Waterproof cap for USB jack. This cap works for either the mini or micro USB options.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Bluetooth Module OPTIONAL (OPTION 1)	1	Various	HM-10	HM-10 Bluetooth Serial Module	Amazon	RXD TXD GND VCC(3.6V-6V)

**Notes:** *Bluetooth communications module.* This component is intended for future interfacing with TopoDroid or similar software running on an Android tablet but this function has not yet been added. The HM-10 is a Bluetooth 4.0 LE device so is only compatible with newer tablets and draws less power. Multiple variants and vendors are available for this component and so long as it is an HM-10 and operates on +5V, it should work.

Bluetooth	1	Various	HC-05	HC-05 Bluetooth	Amazon	EN EN
Module				Serial Module		→ VCC(3.6V-6V)
0.555						- GND
OPTIONAL (OPTION 2)						RXD
(OF HON 2)						STATE

**Notes:** *Bluetooth communications module.* This component is intended for future interfacing with TopoDroid or similar software running on an Android tablet but this function has not yet been added. The HC-05 is a Bluetooth 2.0 device so is compatible with older tablets but draws more power. Multiple variants and vendors are available for this component and so long as it is an HC-05 and operates on +5V, it should work.

MicroSD Card	1	Various	Various	SanDisk 32GB Ultra microSDHC UHS-I Memory Card	Amazon and many other sources	SanDisk <i>Ultra</i>
						32 <sub>GB</sub> MSS 1 © A1

**Notes:** *Storage for Caveatron data.* Numerous brands and sources available. MicroSD card must be SDHC type not larger than 32 GB (smaller capacities are fine as well). SanDisk brand is preferred as they are generally the most reliable.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Tee nsy USB connector	1	N/A	N/A	Micro USB Male Solder Connector	Amazon and many other sources	

**Notes:** For the cable to connect the exterior USB jack to the Teensy. Wires are soldered between this part and the USB jack connector pins. Note that only the D+, D-, and GND are connected on this plug. The USB power (and a second GND wire) goes from the USB jack to a plug on the main PCB.

**Notes:** Cable to connect to LCD Touchscreen from the Caveatron main board. Cables longer than 6" would take up too much space in the enclosure while those shorter than 4" are not long enough. These are available from multiple vendors. Note that some of these connectors do not include one of the middle pins, however those are fine since that pin is not used.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo			
JST Connector 5-pin	2 or 3	Various	JST-XH	JST 2.54mm pitch, 5 pin, male connector	Amazon, Ebay and others				
Notes: Conne	ctor for LRF	and power switch.	If you order th	em prewired as in the photo, b	e sure they are at least	100 mm in length.			
JST Connector 2-pin	3 or 4	Various	JST-XH	JST 2.54mm pitch, 2 pin, male connector	Amazon, Ebay and others				
		USB data, USB po ery if you order a b			hem prewired as in the	photo, be sure they are at least 100 mm in length. (You			
Socket Headers 1	1 (6 pin positions needed)	Prec-Dip or others	310-87- 106-41- 001101	Socket header, 0.1" pitch, 4.2 mm insulation height, single row, 6 pins	Digikey and others				
						ed since the RM3100 has tall components. This header size is on one side and 2 pins on the other.			
Socket Headers 2	3 (54 pin positions needed)	Prec-Dip or others	801-87- 024-10- 001101	Socket header, 0.1" pitch, 7.0 mm insulation height, single row, 24 pins	<u>Digikey</u> and others				
	Notes: Header sockets for Teensy and IMU. Optional but this shorter size is preferred over the more common 8.51mm height to avoid interference with the display. Other variants with different numbers of pins are available. Two sets of 24 pins and 1 additional pin are needed for the Teensy and 5 pins are needed for the IMU module.								

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo			
Screen Protector	1	Supershieldz	N/A	iPhone SE and iPhone 5 Screen Protector	<u>Amazon</u>	Screen Protestor			
		for touchscreen. N . Multiple vendors			een protector film for iPhone	4, 4S, 5, 5s, or SE should work as they have the same screen			
Threaded Inserts for Enclosure	4	Initeq		#6-32 Threaded Heat Set Inserts for 3D Printing (Long)	<u>Ebay</u>				
Notes: Heat se	t thread	led inserts used in	3D printed e	nclosure.					
Threaded Inserts for external mounting (Optional)	1	Initeq		#1/4-20 1/4" Threaded Heat Set Inserts for 3D Printing (Short)	<u>Ebay</u>				
	<b>Totes:</b> Heat set threaded inserts used in 3D printed enclosure for external mounting. This is an optional part if you plan to attach something external to the Caveatron (like a andle) or mount it to a tripod.								

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo			
LRF Window Material	1	Sibe Polymers	5064981212	Clear Acrylic Plexiglass 12" x 12" - 3/32" (.090)	Amazon				
Notes: Transp	parent a	crylic sheet for LR	F window on Ma	in Body.					
Wrist Strap Lanyard	1	Hukado	N/A	Hukado Adjustable Hand Wrist Straps Lanyard, (6 Pack) 9.5 inches Nylon Lanyard	Amazon				
Notes: Wrist S	Notes: Wrist Strap. This wrist strap works well, but other options are available in various lengths depending on your preference.								
O-Ring Seals	4 ft	The O-Ring Store	N50.103/10	0.103" (2.62mm) Buna-N 50 O-Ring Cord Stock, 10' Piece, Black	O-Ring Store	The Control of the Co			

**Notes:** *O-Ring material for seals in main enclosure and LIDAR module.* This 50 durometer material is preferred over more readily available 70 durometer since it is softer and can make a tighter seal. Must cut to length and glue ends (this vendor also sells O-ring glue in small quantities.) Other vendors sell similar material.

## **Other Required Items:**

Caveatron SV Rev C Printed Circuit Board

CR1220 Battery

Single row male headers, 2.54 mm (0.1") pitch

Double row female headers 2x20 (for 40 pin LCD Connector), 2.54 mm (0.1") pitch

Soldering supplies

6-32 x 1/2" Flat Head Screws (4x)

 $4-20 \times \frac{1}{2}$ " thread rolling screws (3x)

4-20 x <sup>1</sup>/<sub>4</sub>" thread rolling screws (10x)

2-28 x <sup>1</sup>/<sub>4</sub>" thread rolling screws (15x)

PETG filament for 3D printed parts

O-Ring grease

O-Ring epoxy

Flexible waterproof epoxy sealant

Adhesive-backed foam

Tape (Kapton or cellophane)

**Notes:** For assembly and electrical interconnections between boards.