## Caveatron SV Bill of Materials Hardware Revision: A

Date: 2021-04-18

All the parts in this list have been tested with the Caveatron and have either been integrated into the code or are planned to be.

For some parts, alternate options are available.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Main Processor	1	PJRC Electronics	Teensy 3.6	Teensy 3.6	PJRC Store	MK66FXIMSYMO18 SN65N OT A G163BJ
Notes: The mai	in systen	n processor. Availa	ble from multipl		and without the pins pr	re-installed are available (link above is with pins).
Touchscreen LCD		BuyDisplay	N/A	LCD 3.5" 320x480 TFT Display Module, OPTL Touch Screen w/Breakout Board  Options: -Resistive touch panel -16-bit 8080 40-pin header -3.3V supply -No font chip	<u>BuyDisplay</u>	Workspace  Social Vibes St powder  Store Competition  Colleague Locator  Store Competition  Staff Time Off Cupier West Social Vibra Social Vibra Social Vibra Staff Time Off Cupier West Social Vibra So

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Graphics Module (SPI Flash Memory)	1	Multiple (Winbond IC)	W25Q64 or similar	W25Q64 64Mbit 8MByte Flash Memory Module Data Flash SPI Interface	<u>Amazon</u>	Bes Do W250XX

**Notes:** *Storage for fonts and graphics used in the GUI.* SPI Flash memory must be Winbond W25Q32, W25Q64, or W25Q128 (memory size should be 32Mbit or higher.) Winbond W25Q16 (16 Mbit) could be used, but will only hold the fonts and not support the graphics.

Laser Rangefinder	1	JRT Meter Tech., Co, Ltd.	Unknown	40m – 60m Laser Distance Sensor Module	Ebay Availability changes frequently. Site	
OPTION 3					linked above has availability as of the date of this BOM	

Notes: Used for station distance measurements. There are several variants of this module. Be sure to get the small one that is about 50 mm(2") in length.

	1					
IMU/	1	Pololu	MinIMU-	AltIMU-10 v3 Gyro,	<u>Pololu</u>	
Compass			9 v5	Accelerometer,		
Module			(#2738)	Compass, and Altimeter		
			, ,	(L3GD20H, LSM303D,		
OPTION 1			Or	and LPS331AP Carrier)		
01110111						
			AltIMU-			
			10 v5			
			(#2739)			
						C.

**Notes:** *Used to determine orientation of the Caveatron and measure azimuth and inclination.* This is the best currently available IMU module option although the discontinued models below have half the noise floor if you can find them. The AltIMU-10 v5 is an equivalent part and can also be used (the altitude sensor is not used).

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>	Litton Bess 3 to 2M GR Carlot 15 to
	y system	1	ì	1	-	le from Tenergy (PN 30011) but is not connectorized: <u>Tenergy</u>
Battery Pack OPTION 2	1	Adafruit	1781	Lithium Ion Cylindrical Battery - 3.7v 2200mAh	<u>Adafruit</u>	ICR18650 2200 with 3.7U
Notes: Primar	y system	battery. This optio	n is a lower capa	city battery but might be	an option if you are una	able to obtain the higher capacity option above.
Bluetooth Module OPTIONAL (OPTION 1)	1	Various	HM-10	HM-10 Bluetooth Serial Module	<u>Amazon</u>	TXD GND VCC(3.6V-6V)
function has no	t yet be	en added. The HM-	10 is a Bluetooth		compatible with newer	old or similar software running on an Android tablet but this rablets and draws less power. Multiple variants and vendors are
Bluetooth Module OPTIONAL (OPTION 2)	1	Various	HC-05	HC-05 Bluetooth Serial Module	Amazon	EN VCC(3.6V-6V) GND TXD RXD 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.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Battery Charger Module	1	Unknown	Unknown	Lithium Ion 3.7V Charger Module	Amazon	SANYA RIO BA

**Notes:** *Battery charging module.* There are several sources for this module and at least 2 variants. Be sure to get the variant with all the 4 power pins all on the same side to work with the Caveatron SV PCB. These are usually on a red PCB.

10k resistor	2	Various	Various	SMD resistor, 10k-ohm, 1%, 1206 package	<u>Digikey</u>	
--------------	---	---------	---------	--	----------------	--

**Notes:** Resistor for battery monitor voltage divider and IMU power input. Available from numerous manufacturers and vendors - the above is only 1 example. <sup>1</sup>/<sub>4</sub> watt or less is fine since this carries no significant current.

3.3k resistor	1	Unknown	Unknown	SMD resistor, 3.3k-ohm, 1%, 1206 package	<u>Digikey</u>	
---------------	---	---------	---------	--	----------------	--

**Notes:** Resistor for battery monitor voltage divider. Available from numerous manufacturers and vendors - the above is only 1 example. <sup>1</sup>/<sub>4</sub> watt or less is fine since this carries no significant current.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Voltage Regulator – 5V	1	Pololu	2119	5V Step-Up/Step-Down Voltage Regulator S7V7F5	Pololu	
Notes: Power	supply	for Teensy.				
Voltage Regulator – Adjustable	1	Pololu	2118	Pololu Adjustable Step- Up/Step-Down Voltage Regulator S7V8A	Pololu	
Notes: Power	· supply	l for Laser Rangefind	der. Output	needs to be set to 3.0V.	L L	
Power Switch Module	1	Pololu	2808	Mini Pushbutton Power Switch with Reverse Voltage Protection, LV	<u>Pololu</u>	

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Piezoelectric Buzzer	1	Uxcell	A1406240 0ux0199	uxcell A14062400ux0199 5 Pcs DC 2-28V 80Db Sound Electronic Passive Buzzer Alarm Black, 22 x 4.5 mm	Amazon	
Notes: Indicate	or buzze	r. This is a smaller	size than the	regular Caveatron buzzer		

Power Switch & Charging	1	Adafruit	3350	Rugged Metal Pushbutton - 16mm 6V	<u>Adafruit</u>	
LED				RGB Momentary	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. Other 16mm momentary pushbutton switches from Adafruit are available with a single color LED, though they are longer in length, so may not fit well in the enclosure. If you buy from another source be sure to get the common anode version.

|--|

Notes: Mini-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.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
USB Cap	1	GT Contact	GT1C522 122	Seal Cap	USBFirewire. com	SBFireWire.com

**Notes:** Waterproof cap for USB jack.

RTC Battery Holder	1	MPD and others	BC501S M	Coin Cell Battery Holder - 12mm	<u>Digikey</u>	
				(for CR1220 batteries)	<u>Amazon</u>	

**Notes:** *Holds a CR1220 battery to provide power to maintain the Real-time clock on the Teensy 3.6.* Identical holders are available from many sources with differing part numbers but those I have checked that are surface mount all have nearly identical dimensions so should work.

MicroSD Card	1	Various	Various	SanDisk 16GB Ultra microSDHC UHS-I Memory	<u>Amazon</u>	SanDisk <i>Ultra</i>
				Card		16 <sub>GB</sub> MSS (© A1

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

Item	Qty	Manufacture r	Mfr. P/N	Description	Suggested Vendor Link	Photo
LCD Connector Cable	1	N/A	N/A	40 pin IDE Male to Female Extension Cable, 4" (10 cm) or 6" (15 cm)	Ebay or Amazon	

**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.

Connector 5-pin Ebay and others	JST Connector 5-pin
---------------------------------	---------------------------

Notes: Connector for LRF, power switch, and Bluetooth module. If you order them prewired as in the photo, be 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	
---------------------------	----------------	--------	--	-------------------------------	--

**Notes:** Connector used for USB data, USB power, piezo buzzer, and battery. If you order them prewired as in the photo, be sure they are at least 100 mm in length. (You many not need one for the battery if you order a battery that is pre-connectorized

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
Threaded Inserts for Enclosure	10	Initeq		#6-32 Threaded Heat Set Inserts for 3D Printing (Long)	Amazon	
	t thread	ed inserts used in 3	D printed enclo.			
Threaded Inserts for external mounting (Optional)	1	Initeq		#1/4-20 1/4" Threaded Heat Set Inserts for 3D Printing (Short)	<u>Amazon</u>	
Notes: Heat set handle) or mou			D printed enclo	sure for external mounting. This is	an optional part	if you plan to attach something external to the Caveatron (like a
2-28 Thread Rolling Screws	14	Small Parts		410 Stainless Steel Thread Rolling Screw for Plastic, Passivated Finish, Pan Head, Phillips Drive, #2-28 Thread Size, 1/4" Length	Amazon	
Notes: Screws	for three	ading directly into	3D printed holes	<u> </u>	_	
4-20 Thread Rolling Screws	10	Small Parts		410 Stainless Steel Thread Rolling Screw for Plastic, Passivated Finish, Pan Head, Phillips Drive, #4-20 Thread Size, 1/4" Length	Amazon	

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo
LRF Window Material	1	Sibe Polymers	506498121	Clear Acrylic Plexiglass 12" x 12" - 3/32" (.090)	<u>Amazon</u>	

**Notes:** Transparent acrylic sheet for Rangefinder window on Main Body. The 0.118" transparent acrylic sheets used for the LIDAR windows could be used as well if you don't want to order this 0.090" thick sheet. Requires cutting to size.

Screen Protector  Supershieldz  N/A  iPhone SE and iPhone 5 Screen Protector  Amazon  Amazon	 	o o o o o o o o o o o o o o o o o o o			
Screen Protector Screen Protector	1	Supershieldz	N/A	<u>Amazon</u>	TUDEr Shieldz

**Notes:** *Protection film for touchscreen.* Needs to be cut to length. Most any PET screen protector film for iPhone 4, 4S, 5, 5s, or SE should work as they have the same screen width as the 3.5" LCD. Multiple vendors produce a similar product.

Item	Qty	Manufacturer	Mfr. P/N	Description	Suggested Vendor Link	Photo			
Wrist Strap Lanyard	1	Hukado	N/A	Hukado Adjustable Hand Wrist Straps Lanyard, (6 Pack) 9.5 inches Nylon Lanyard	Amazon				
Notes: Wrist S	Strap. T	his wrist strap work	s well, but o	ther options are available in various le	engths 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 Constitution 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.								
USB Connection Pins OPTION 1	2	Mill-Max	0929-7	Spring-loaded contacts – through- hole mount (Pogo pins)	<u>Digikey</u>				
				on underside of Teensy. This can be dhe usual 2.54 mm (0.1") spacing. The		o pins or with right angle pins and shorter header receptacles. is preferred.			
USB Connection Pins	1	Harwin	M22- 2531005	Connector Header – through hole, right angle, 2mm	<u>Digikey</u>				
OPTION 2	1	Samtec	SQT- 102-01- L-S	Connector Receptacle – through hole, 2mm	<u>Digikey</u>				

**Notes:** *Special pins to make connection to USB pads on underside of Teensy.* This can be done with two pogo pins or with right angle pins and shorter header receptacles. Note that these pads have a 2 mm spacing instead of the usual 2.54 mm (0.1") spacing.

## **Other Required Items:**

PETG Filament for 3D Printing

Caveatron SV Printed Circuit Board

CR1220 Battery

Single row male headers Single row female headers

Double row female headers 2x20 (for 40 pin LCD Connector)

6-32 x 1/2" Flat Head Screws (8x)

6-32 x 3/8" Pan Head Screws (4x)

6-32 x 9/16" Pan Head Screw (1x)

6-32 Nut (3x)

Adhesive-backed foam

Epoxy, sealant, and grease

Tape (Kapton or electrical)

Soldering supplies

Notes: For assembly and electrical interconnections between boards. Several sizes of standard hardware required. More information in assembly instructions.