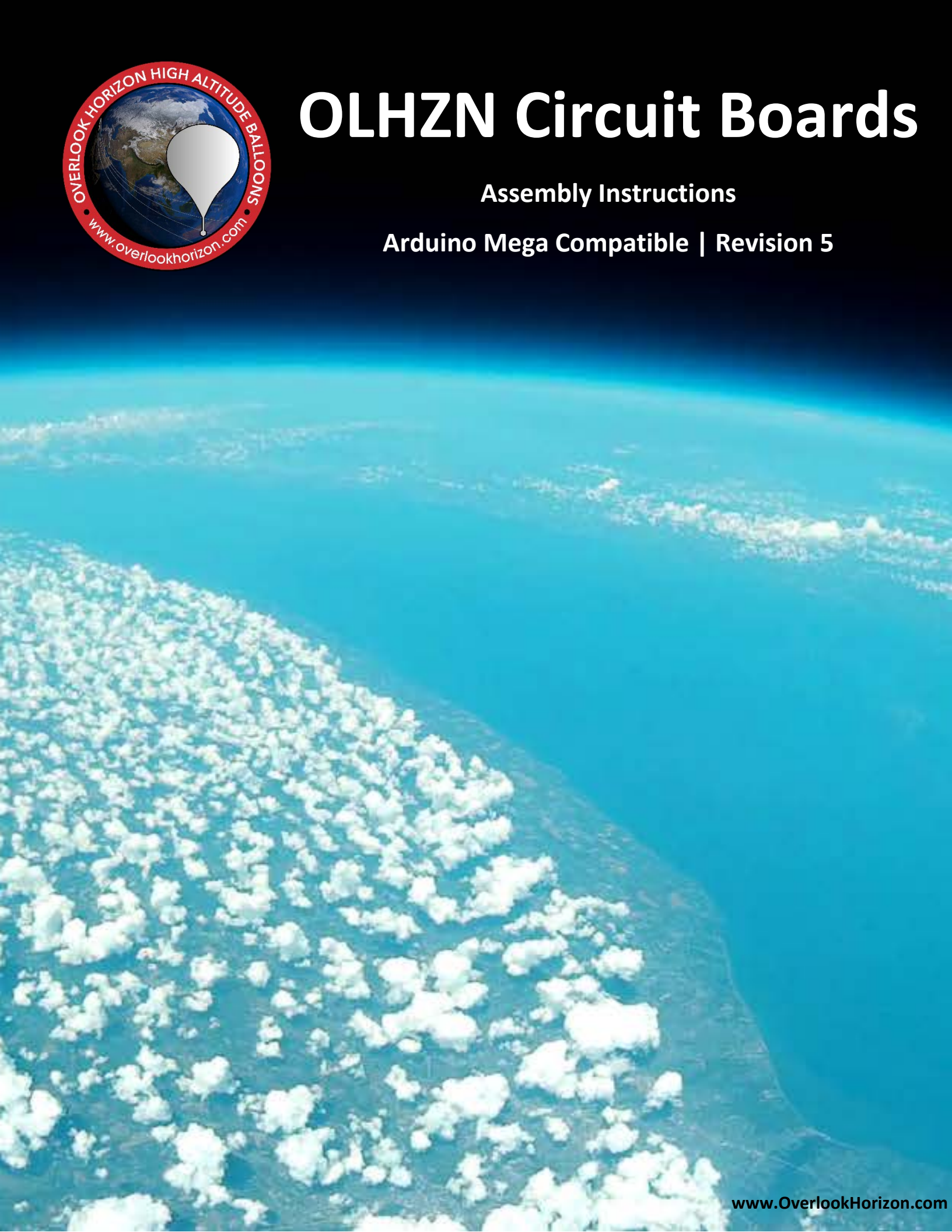
OLHZN Circuit Boards

Assembly Instructions

Arduino Mega Compatible | Revision 5



www.OverlookHorizon.com

What is Overlook Horizon?

Overlook Horizon Inc. (OLHZN) is a 501(c)(3) non-profit charitable organization with the goal of educating and inspiring the next generation of scientists and engineers to shape our world. We fly high altitude weather balloons for science and fun! We hope to inspire students into careers involving science, technology, engineering and mathematics! Learn more at: www.OverlookHorizon.com

What is this circuit board?

The OLHZN circuit boards are experimental bare circuit boards intended for data logging and radio position tracking for high altitude weather balloons using the Arduino platform. You will need to purchase the electronic components separately and assemble the board using some basic soldering skills. The Arduino Mega Revision 5 board is our 5th revision to our tracking system and contains fixes and improvements from our 4th revision.

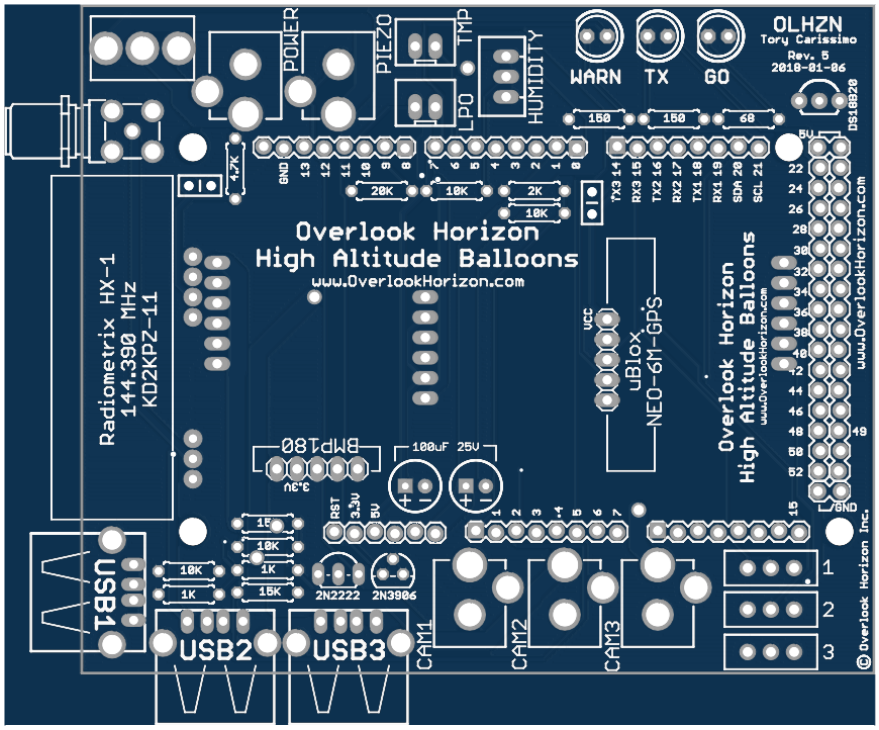
What is the success rate?

The revision 5 board has not yet been flown onboard an actual flight. Its first flight is scheduled for March 2018. We cannot confirm the success rate of this board yet. A backup tracking method is recommended in the event that there are undiscovered errors or technical deficiencies.

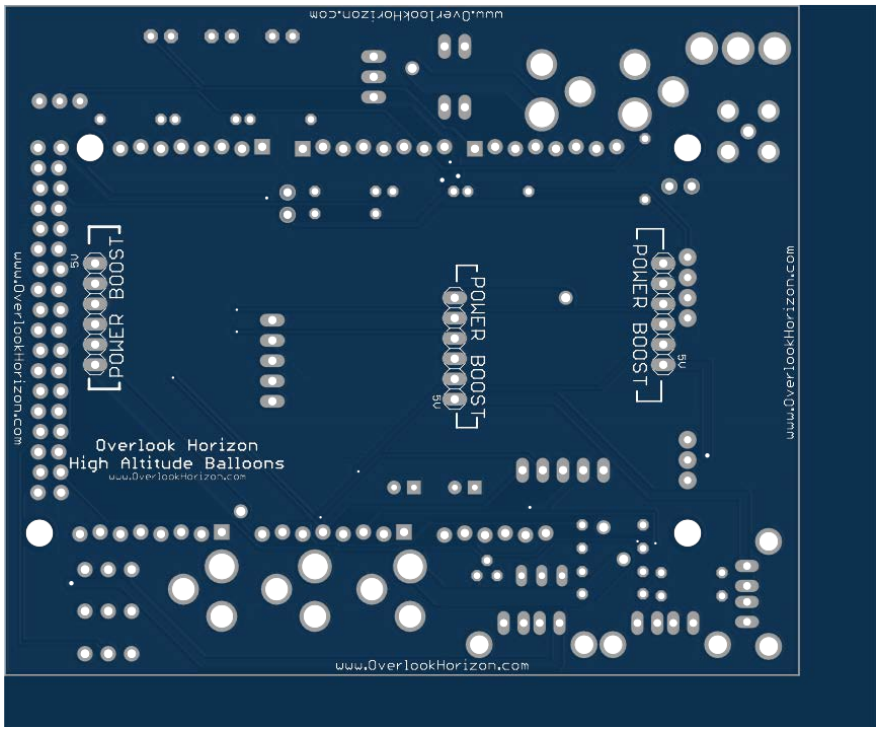
What software do I need?

For this model, you can run our "**OLHZN_Track**" software on Arduino Mega which can be downloaded from http://github.com/OverlookHorizon. Feel free to make any modifications, improvements or upgrades to the code and let us know if you find any errors by contacting us at Info@OverlookHorizon.com

Top View



Bottom View



Note that the Adafruit PowerBoost Breakout Boards are mounted on the **BOTTOM** of the circuit board.

PCB Parts List

You will need to purchase the following parts to assemble this circuit board:

Component	Qty	Source
3 Pin SPDT Toggle Switch	1	http://amzn.to/2BpK94r
5.5mm x 2.1mm Female DC Power Jack	5	http://amzn.to/2E47uvq
2 Pin JST Female Connector	2	http://amzn.to/2E5V3PY
3 Pin JST Female Connector	1	http://amzn.to/2E5V3PY
DS18B20 Temperature Sensor	1	http://amzn.to/2DCTTxz
5mm LED Red	1	http://amzn.to/2Dw0E0K
5mm LED Yellow	1	http://amzn.to/2Dw0E0K
5mm LED Green	1	http://amzn.to/2Dw0E0K
0.1uF 50V Ceramic Capacitor	2	http://amzn.to/2Dxqy4g
100uF 25V Polarized Capacitor	2	http://amzn.to/2BqkoRN
3mm 3 Pin SPDT Slide Switch	3	http://amzn.to/2Bpmlhi
USB Female Type A 4-Pin Right Angle Connector	3	http://amzn.to/2DzgasY
2N3906 PNP Transistor	1	http://amzn.to/2DvZ9j6
2N2222 NPN Transistor	1	http://amzn.to/2DByeGN
SMA Female Right Angle Connector	1	http://amzn.to/2E7NpEM
1/4W 20KΩ Resistor	1	http://amzn.to/2DARcNN
1/4W 10KΩ Resistor	4	http://amzn.to/2DARcNN
1/4W 2KΩ Resistor	1	http://amzn.to/2DARcNN
1/4W 1KΩ Resistor	2	http://amzn.to/2DARcNN
1/4W 4.7KΩ Resistor	1	http://amzn.to/2DARcNN
1/4W 15KΩ Resistor	2	http://amzn.to/2DARcNN
1/4W 150Ω Resistor	2	http://amzn.to/2DARcNN
1/4W 68Ω Resistor	1	http://amzn.to/2DARcNN
6-Pin Stackable Shield Header	1	http://amzn.to/2F8WJYg
8-Pin Stackable Shield Header	5	http://amzn.to/2F8WJYg
18-Pin Stackable Shield Header	2	http://amzn.to/2DH3J1g
U-blox NEO-6M 5 Pin Active GPS Breakout	1	http://amzn.to/2GdOnzG
BMP180 Pressure, Temperature, Altitude Breakout	1	http://amzn.to/2DuQCwN
Adafruit PowerBoost 1000 Basic Breakout	3	http://amzn.to/2DvYv5i
Radiometrix HX-1 Radio Transmitter	1	http://olhzn.com/HX1

External Parts List

The following parts are not necessary to assemble the circuit board, but the circuit board is designed to work with these external components to complete the full setup. Many of these components can be omitted or replaced, if desired. These are the components we use.

Component	Qty	Source
Orbtronic 3400mAh 18650 Li-ion batteries	5	http://amzn.to/2GcfxqK
5.5x2.1mm Male DC Power Plug	5	http://amzn.to/2GfsRLc
HYD-4218 Active Piezo Alarm	1	http://amzn.to/2DDyOTM
18650 Single Battery Holder	3	http://amzn.to/2DImS3b
18650 Double Battery Holder	1	http://amzn.to/2Du36F3
DS18B20 Waterproof Temperature Sensor	1	http://amzn.to/2E6pZ2i
Low Voltage Battery Alarm	1	http://amzn.to/2DBzUjE
AM2302 DHT22 Digital Temperature/Humidity Sensor	1	http://amzn.to/2F79KRS
USB 2.0 Type A-Male to Micro B Cable	3	http://amzn.to/2Dw4eIc
Lightdow LD4000 Action Camera	3	http://amzn.to/2DGPfyk
SMA Male to Male Connector	1	http://amzn.to/2Dw1GKg
Nagoya NA-771 15.6 Inch Whip Antenna 144MHz	1	http://amzn.to/2Ge6zsY
Arduino Mega 2560 R3	1	http://amzn.to/2Dznetm
RTC Data Logging Shield	1	http://amzn.to/2DzKyY9
16GB Class 10 SD Card	1	http://amzn.to/2DzKzvb
USB 2.0 Type A Male to Type B Male Cable	1	http://amzn.to/2E6AAdF
Dupont Cable Crimper	1	http://amzn.to/2DxJ10C
18650 Battery Charger	1	http://amzn.to/2GcjoEt
Extra Straight Single Row Header Pins		http://amzn.to/2E5VZny
Copper Shielding Tape	1	http://amzn.to/2BqlL2J

Camera Warning

The Lightdow LD4000 action cameras create a large amount of electromagnetic interference. The active GPS antenna we recommend resolves much of this, but we still recommend wrapping the LD4000 cameras in copper tape to create a faraday cage around the cameras to contain as much of the electromagnetic interference as possible. Too much interference will cause the GPS to lose signal and can lead to the Arduino randomly crashing or freezing.

PCB Assembly Order

We recommend starting with the small and inexpensive parts, first in case you make a mistake. Desoldering these boards can be tricky. You can assemble in any order, but we follow and recommend this assembly order:

1. Resistors
2. Transistors
3. Capacitors
4. SMA Female Connector
5. Female DC Connectors
6. USB Female Connectors
7. SPDT Slide Switches
8. SPDT Toggle Switch
9. JST Female Connectors
10. LEDs
11. DS18B20 Temperature Sensor
12. BMP180 Breakout
13. U-blox GPS Breakout
14. Radiometrix HX-1 Radio Transmitter
15. Adafruit PowerBoosters
16. Stackable Headers

PCB Assembly Tips

- **BMP180 Breakout Board**
  When mounting this component, we recommend mounting it flat against the board. To do this, solder on the header pins to the breakout board. Next, use pliers to remove the plastic spacer on the header pins. Finally, solder the breakout board so it lays flat against the circuit board. The board has room for a 5-pin breakout board, but many of the BMP180 breakout boards only have 4-pins. Be sure the 3V power pin of the breakout board lines up with the 3.3V labeled pin.

- **Adafruit PowerBoost 1000 Basic Breakout Boards**
  These breakout boards should also be mounted flat, like above. Note, that these breakout boards should be mounted on the **BOTTOM** of the circuit board. Be sure that the 5V labeled pin on the circuit board matches the 5V output pin on the breakout board.

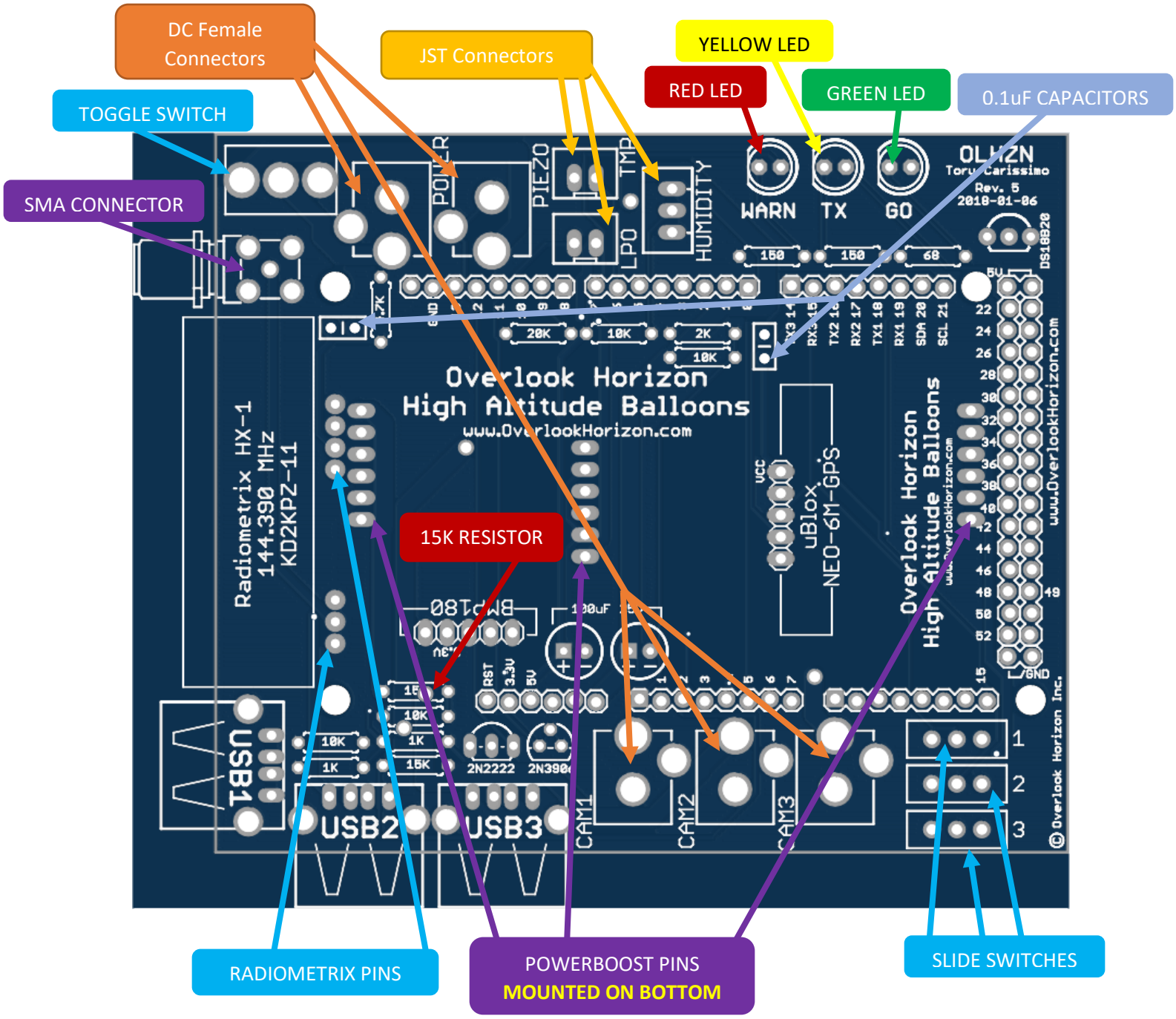
- **U-blox NEO-6M GPS Breakout Board**
  This breakout board is designed to be mounted perpendicular to the circuit board so that the breakout board sticks straight up from the circuit board. When looking at the circuit board picture below, the breakout board should be to the right of the through holes (within the bracket) and the pins should be mounted so they stick out the left side of the breakout board. This allows enough space to stack an Arduino Uno sized shield on top of our circuit board. Be sure the 5V labeled pin on the circuit board matches the VCC pin on the GPS breakout board.

- **Radiometrix HX-1 Radio Transmitter**
  This breakout board is designed to also lay flat against the circuit board, but it comes with its own pins. When soldering the transmitter, place the pins in the through holes and bend/fold the transmitter so it lays flat within the rectangular bracket printed on the board. Once the transmitter is in place, you may then solder the pins. This will ensure the transmitter body is out of the way of the Power Booster pins which are very close to the Radiometrix pins.

- **Double Row Stackable Headers**
  If you can find an 18-pin stackable header, fantastic! If you're not able to locate an 18-pin stackable header, you can use adjacent 8 and 10 pin stackable headers. If you do this, we recommend alternating the pins for better stability so that one row is 8, then 10 pins and the other row is 10 then 8 pins. This ensures the break between segments is not in the same spot on both rows.

Components Map

Most of the components are labeled directly on the circuit board itself, but here are some helpful clarifications:



Known Issues

- Use a genuine Arduino Mega, not a knock-off brand. The genuine Arduino has higher quality components and is better protected from brownouts.

- Be sure the coin-cell battery on your data logging shield (if used) is not depleted. We've seen strange behavior from the onboard real-time clock (RTC) in isolated instances. Using the Adafruit data logging shield (http://amzn.to/2E4r8aE) may provide better results since it has a better RTC, but we've not tested that yet. If using the Arduino data logging shield, you'll need to short the solder jumpers closed on the back of the board for compatibility.

- The **OLHZN_Track** software currently utilizes the String class which has some known issues that may contribute to Arduino crashes/freezing/restarts. We intend to replace this by Spring 2018.

- The **OLHZN_Track** software utilizes the NewTone library to control the Piezo speaker/alarm. This library utilizes Timer 2 on the Arduino which directly conflicts with our APRS operations that also utilizes Timer 2. We intend to replace/correct this by Spring 2018.

Post Assembly Operations Map

Once assembled, there are a number of external components that connect to the circuit board. Only the main power is absolutely required. Others can be included or omitted, as desired. If omitted, you'll need to comment/adjust the software code as necessary.