

Uncrewed Aircraft System Pilot kit
(UASP-kit)
User manual for version 3.0

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UASP-kit Overview

How to use this document

This document provides an overview of the Uncrewed Aircraft System Pilot kit (UASP-kit) and its purpose. The sections contain instructions on how to use each of the UASP-kit's features. A simplified version of the setup instructions can be found on the two quick-start guides included in your UASP-kit.

What is the UASP-kit?

The Uncrewed Aircraft System Pilot kit is designed to provide airspace awareness and (optionally) proximity alerts to UAS crews operating in locations where very little, or no, communications network is available. The UASP-kit shows information about nearby aircraft and allows users to set two levels of alerting for potential encroachments on the planned operating areas. It is a self-contained, portable, prototype tool developed by NASA.

This version (3.0) of the standalone system has the same basic functions as previous versions with improvements to make the system more robust to degraded comms environments, add an additional Automatic Dependent Surveillance-Broadcast (ADS-B) receiver to the kit, and add an encroaching aircraft alerting function to the outlined operational area.

Main features / functions

Here are some of the main features/functions:

- a **map**, this includes a base map, for example, a satellite view, and the ability to import and display an incident map (GeoPDF) as an overlay on the base map;
- a way to define your area of flight operations (**operational volume**), which includes the location, shape, and size of the area your UAS is going to operate in as a graphical representation on the map;
- a display of **traffic reporting ADS-B**, which includes integration with a local ADS-B receiver and a graphical representation of the ADS-B messages or 'tracks', shown on the map; and
- a means to define parameters for **alerting** based on the proximity between ADS-B tracks and the operational volume.

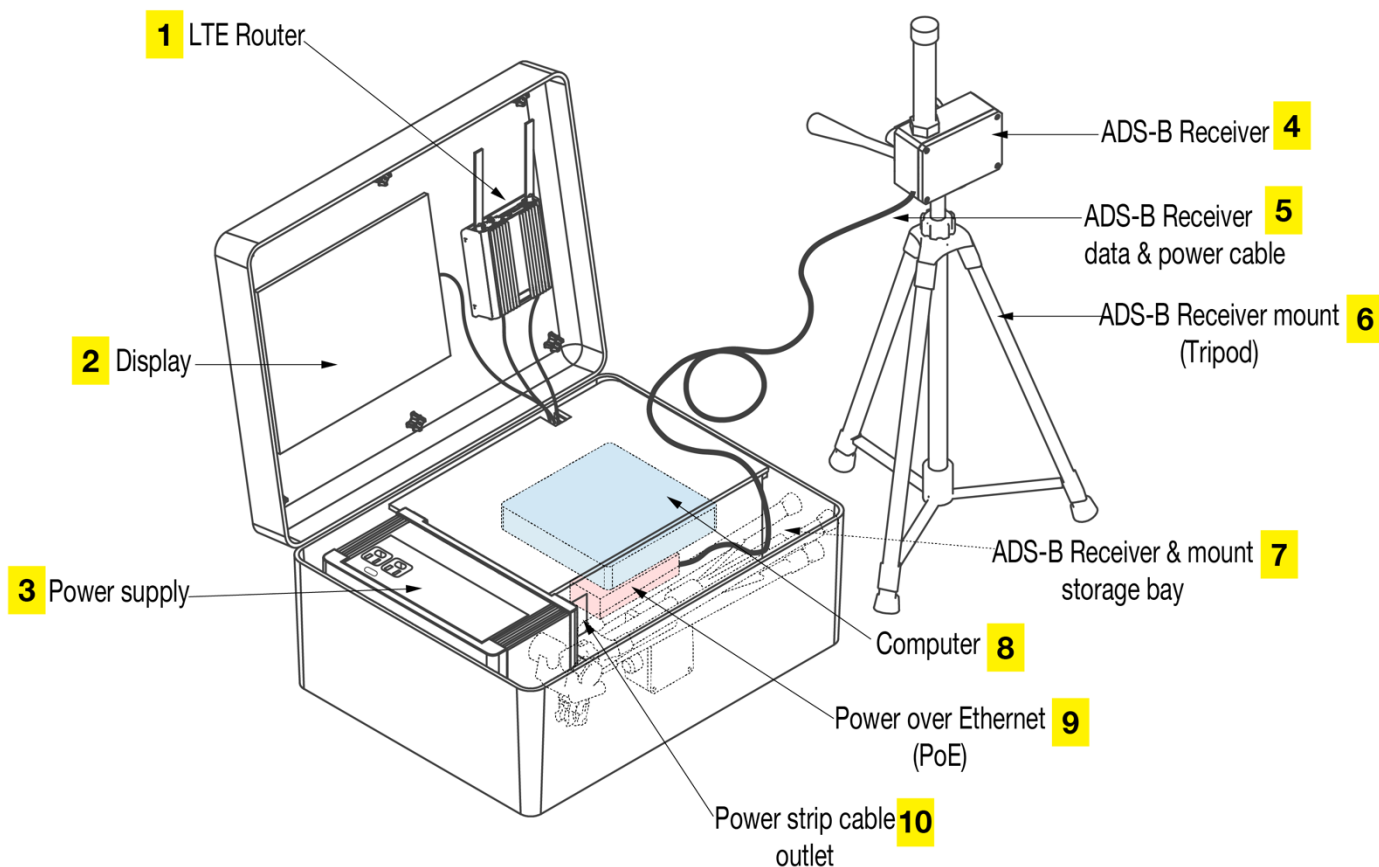
Note about ADS-B

The UASP-kit can only detect aircraft equipped with Automatic Dependent Surveillance-Broadcast transponders that are reporting messages. The ADS-B receiver covers an area that is essentially line of sight and provides a better view of air traffic when positioned in open, elevated areas such as a hilltop with a wide view of the airspace. The UASP-kit will monitor the traffic to extract details from the ADS-B messages, such as callsign, speed and altitude, and will show these in a data tag next to the aircraft icon. Air traffic that is not reporting ADS-B will not be displayed, nor will traffic that is in a shadow – where the signal is blocked by terrain, trees, or structures.

UASP-kit Components

General hardware components

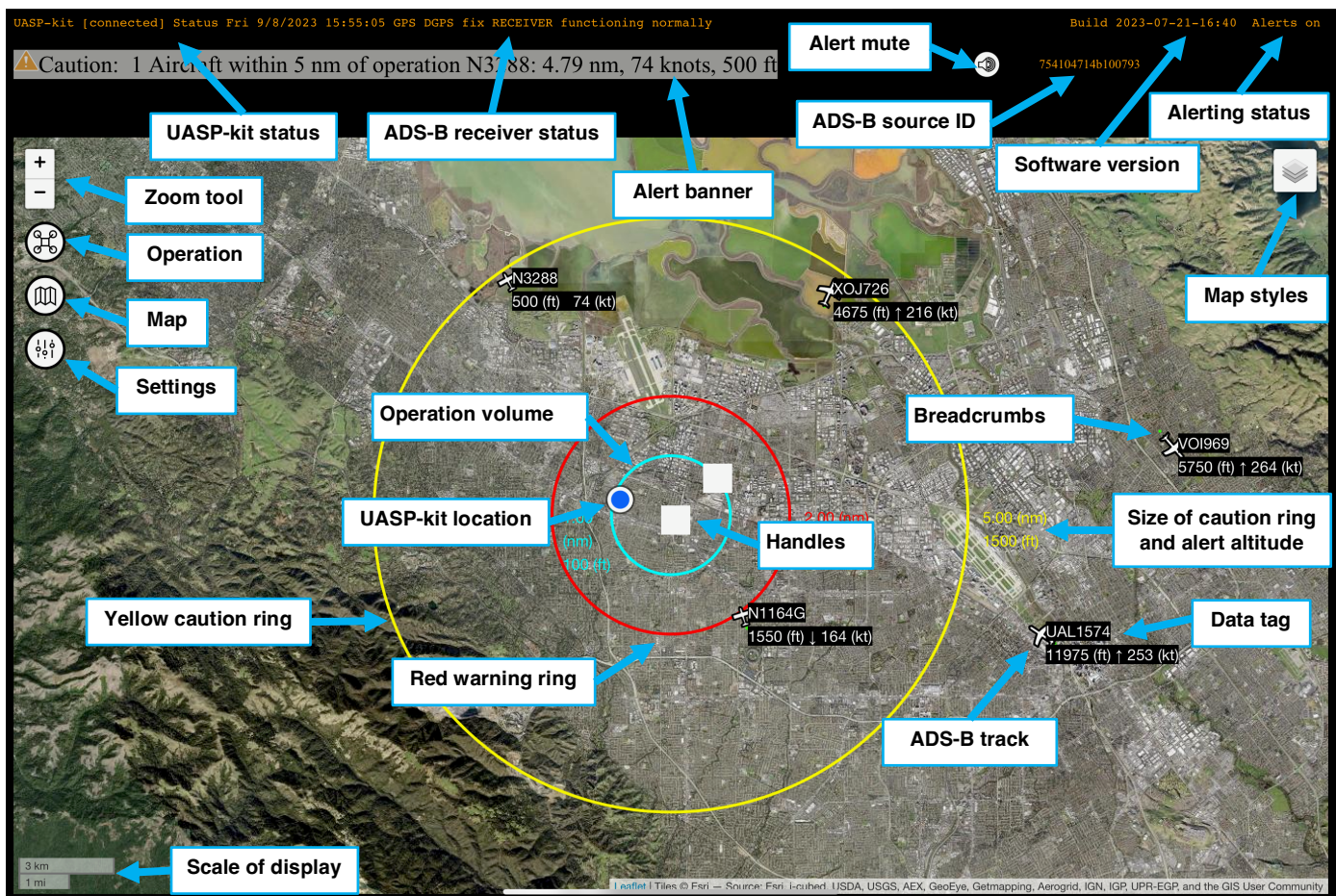
The components of the UASP-kit are shown in the figure below and listed in the table. All the equipment fits into the yellow ruggedized Pelican case. The ADS-B receiver and mount must be unpacked prior to operational use. Once you are done, stow the ADS-B receiver and mount in the storage bay (indicated below, same place from which you unpacked them).



1	LTE router	Cradlepoint Long Term Evolution (LTE) router
2	Display	iPad and iPad charger
3	Power supply	Yeti 500x battery (and charger)
4	ADS-B Receiver	uAvionix PingStation V1
5	ADS-B Receiver data & power cable	50ft Ethernet cable
6	ADS-B Receiver mount (tripod)	GoPro mount on tripod
7	ADS-B Receiver & mount storage bay	
8	Computer	Mac mini
9	Power over Ethernet (PoE)	TP-Link PoE
10	Power strip cable outlet	

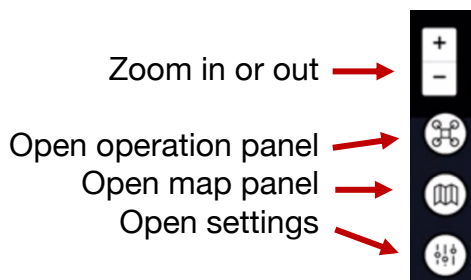
Interface components

The following section provides a high-level description of the information displayed on the UASP-kit interface. Some interface components will be described in more detail in later sections.

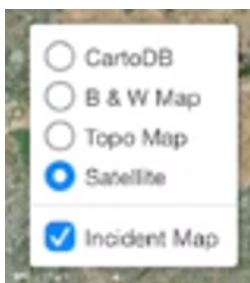


Buttons / controls

On the left of the screen, there are three buttons that open different panels (Operation, Map, Settings). These three panels are where users can: 1) Operation: set up, activate, modify, and close a flight area (operational volume), 2) Map: manage Geo-PDF incident maps, and 3) Settings: set parameters for ADS-B filters and alerting. These panels are described in more detail in section 4. Users can zoom in or out using the +/- buttons on the top left of the screen or can use the pinch-to-zoom touchscreen feature.

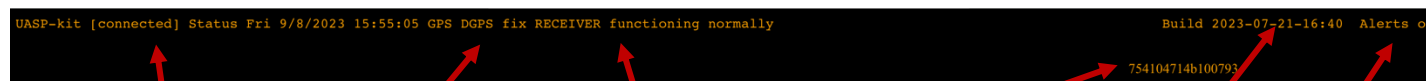


On the right side of the screen, users can choose from four different styles of base map using the Map Style panel. This panel also allows the user to show or hide an incident map that has been loaded onto the UASP-kit.



UASP-kit status bar

The status of the UASP-kit is shown in orange text on the black header bar at the top of the screen. It shows whether the display is connected to the software running on the computer (UASP-kit status), the quality of the GPS, whether the UASP-kit is connected to the ADS-B receiver, the ID of the ADS-B receiver currently connected, the version of the UASP-kit software currently running, and whether the alerting function on the UASP-kit is turned on or off.



UASP-kit
connection status

Quality of
GPS

ADS-B
Receiver status

ADS-B
Receiver ID

UASP-kit
software
version

Status of
alerting

UASP-kit connection status

This tells you if the browser window you are viewing is currently connected to the software running on the computer. The status **[connected]** means the browser window you are viewing has a live connection to the UASP-kit software. The status **[NOT connected]** means the live connection to the UASP-kit software has been lost. In the event this happens, the UASP-kit will automatically attempt to reestablish a live connection. If it is successful, the status will change back to **[connected]**. While the status is **[NOT connected]**, you will not see ADS-B tracks change position.

Quality of GPS

The UASP-kit receives GPS information from the attached ADS-B receiver. Part of this information includes a quality of GPS message. The possible options are: Not present, Not locked, 2D fix, 3D fix, Differential GPS fix (**DGPS** fix), and undefined.

ADS-B Receiver status

The UASP-kit receives an ADS-B receiver status message from the attached ADS-B receiver. The possible options are: **functioning normally**, excessive communication errors, device not transmitting, and undefined.

UASP-kit software version

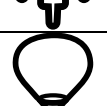
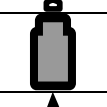
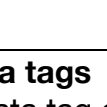
This is the version of the UASP-kit software currently running.

Status of alerting

This tells you whether alerting is turned on or off.

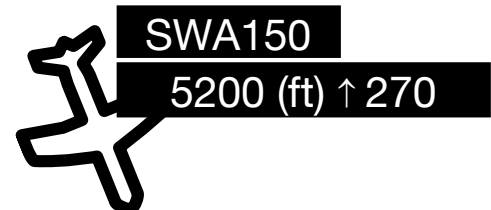
Aircraft icons (ADS-B tracks)

Eight icons are used to denote different types of aircraft on the screen. Icons are assigned based on the ADS-B reported aircraft type.

Icon	ADS-B reported type
	Light (ICAO) < 15,500 lbs
	Small - 15,500 to 75,000 lbs
	Large - 75,000 to 300,000 lbs
	Heavy (ICAO) - > 300,000 lbs
	High Vortex Large (e.g., B757)
	Highly Maneuverable > 5G acceleration and high speed
	Rotorcraft
	Lighter than air Point Obstacle (includes tethered balloons)
	Surface vehicle-emergency vehicle Surface vehicle-service vehicle
	No aircraft type information Glider/sailplane Parachutist/sky diver Ultralight/hang glider/paraglider Unmanned aerial vehicle Space/trans-atmospheric vehicle Cluster Obstacle Line Obstacle

Data tags

A data tag containing information about the current state of the aircraft is attached to each of the aircraft icons (ADS-B tracks). Data tags contain callsign, altitude in feet (ft) MSL (Mean Sea Level), speed in knots, and an arrow indicating whether the flight is descending or ascending.

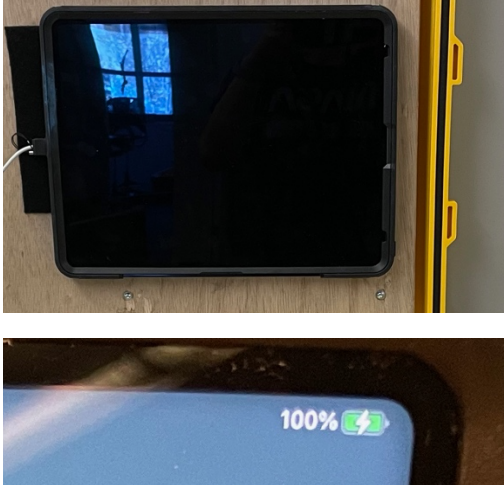


Using the UASP-kit

Initial checks

Battery life of yeti and iPad

Prior to setting up the UASP-kit, you must check the battery level of the yeti battery and the iPad.

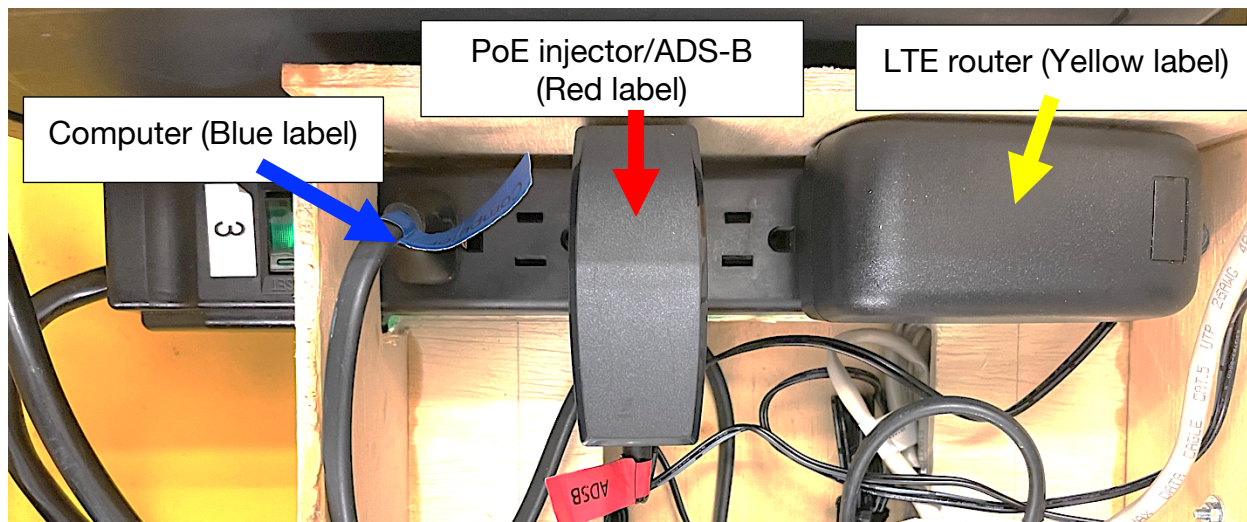
To check the battery of the Yeti, press the INFO button	To check the battery of the iPad, press the power button to wake the iPad
	

You can charge the yeti battery using the supplied charging cable.

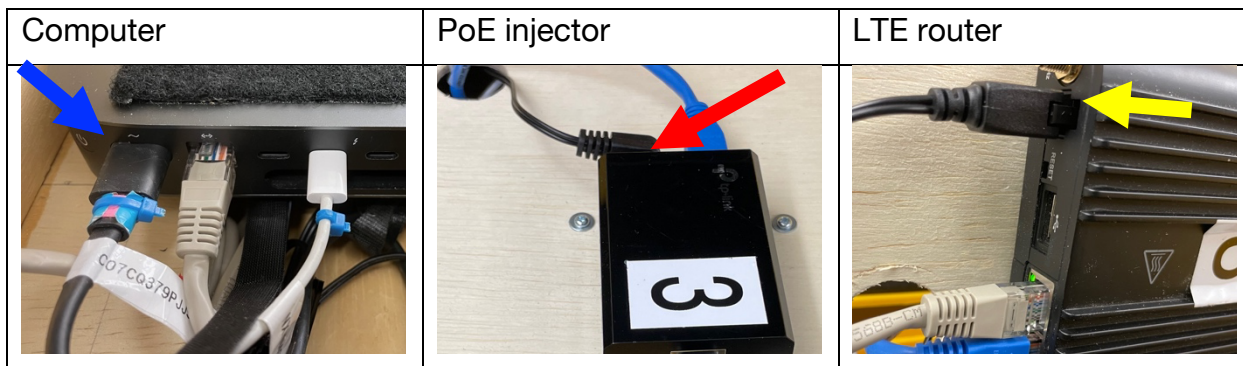
To charge the iPad, you must power on the UASP-kit (the iPad charges through the USB-C cable connected to the computer).

Power cables

1. Open the lid to the internal component housing and check that the computer, LTE router, and PoE injector power cables are firmly connected to the power strip.

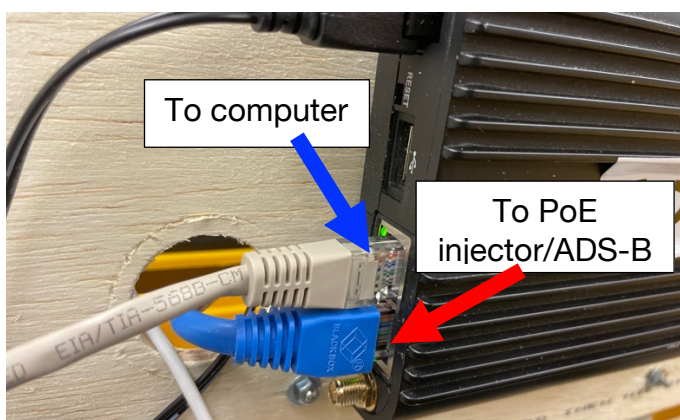


2. Next, check the end of the power cable that plugs into the computer, LTE router, and PoE injector.

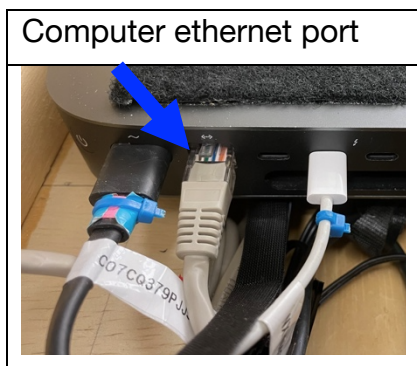


Data cables

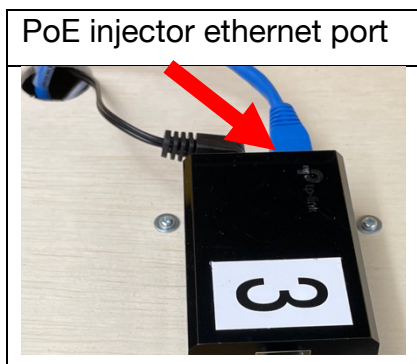
1. Open the lid to the internal component housing and check that the ethernet cables connected to the LTE router are firmly seated.



2. Check that the ethernet cable connected to the computer is firmly seated.



3. Check that the ethernet cable connected to the PoE injector is firmly seated.



Setting up the ADS-B receiver

1. Remove the ADS-B receiver, ADS-B cable, and tripod from the stowage bay next to the internal component housing and set them to the side.



2. Open the lid panel by sliding the slide latch to the right and remove the ADS-B receiver antenna. Set the antenna to the side.

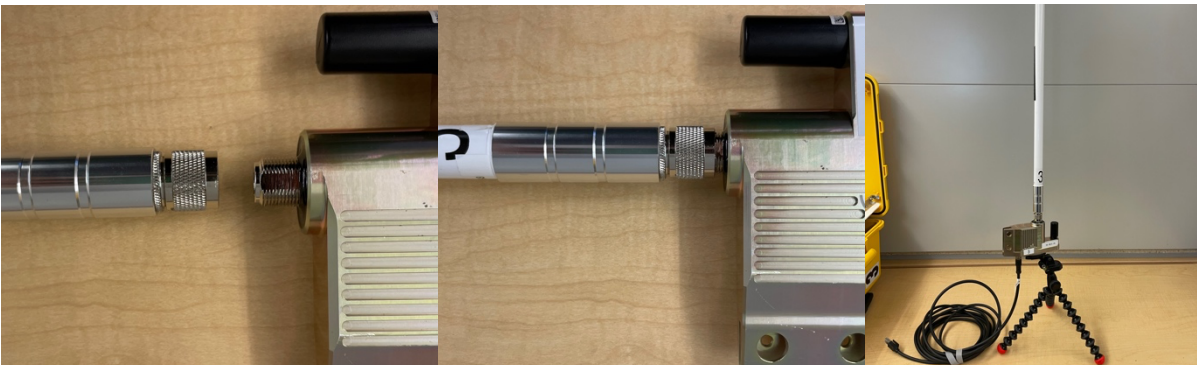


3. Close the lid panel and secure it by sliding the slide latch to the left and through the screw eye.

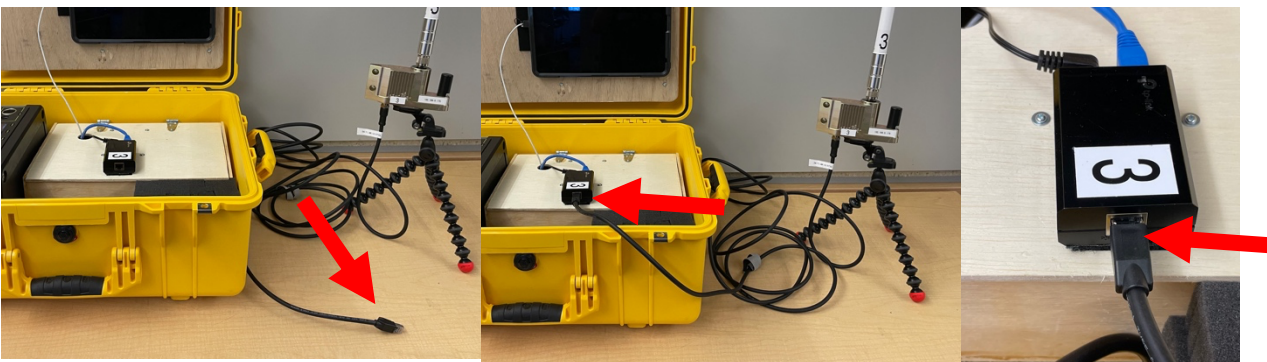
4. Attach the ADS-B receiver to the tripod by connecting the mating parts of the GoPro mounts on each.



5. Connect the M12 end of the ADS-B cable into the ADS-B receiver's M12 receptacle and tighten the connector by turning it clockwise. (Note: when we deliver the UASP-kit, the ADS-B PoE cable will already be connected to the ADS-B receiver.)
6. Attach the ADS-B receiver antenna to the ADS-B receiver (Type-N connector)



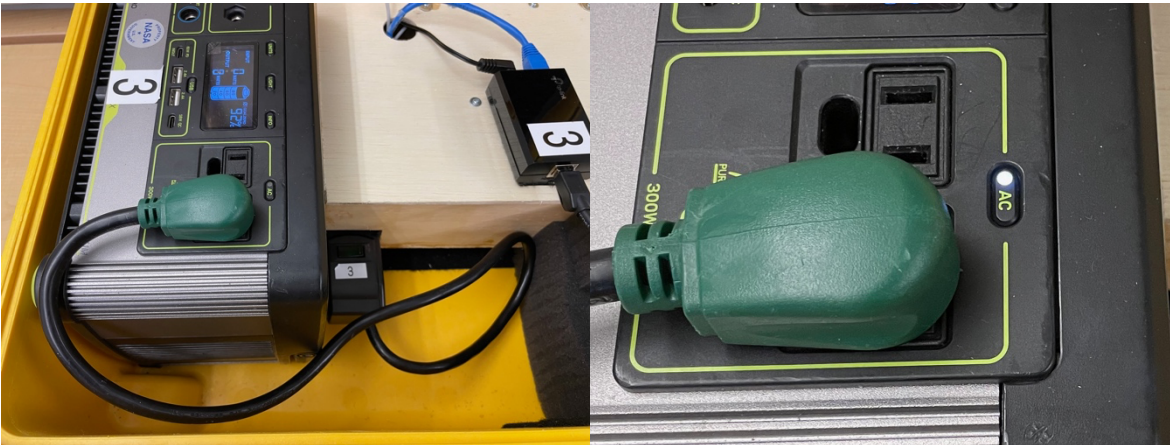
7. Connect the RJ45 end of the ADS-B cable to the PoE injector.



Powering on the UASP-kit

1. Connect the plug end of the UASP-kit's power strip into the AC outlet end of the yeti battery. Press the AC button on the yeti battery to turn on the AC inverter. You will know the AC inverter is on when you see the AC button LED light illuminated.

Note: You can use a different power source for the UASP-kit (e.g., generator). [power requirements; standard NEMA 5-15R wall receptacle]



2. On the UASP-kit's power strip, toggle the master switch ON/RESET. You will know the power strip is on and receiving power when you see the master switch LED light illuminated.



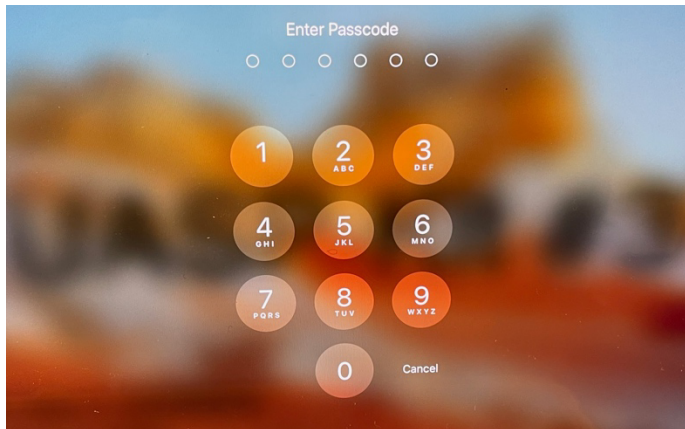
3. Wait 5 minutes.



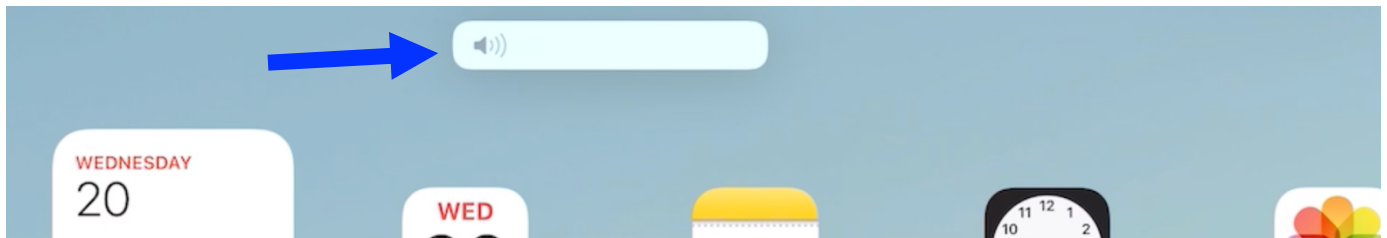
You must wait 5 minutes before proceeding to the next step. This is the time the UASP-kit needs to establish the local network required for the hardware to communicate with the computer, and therefore our software.

Access the UASP-kit's webapp

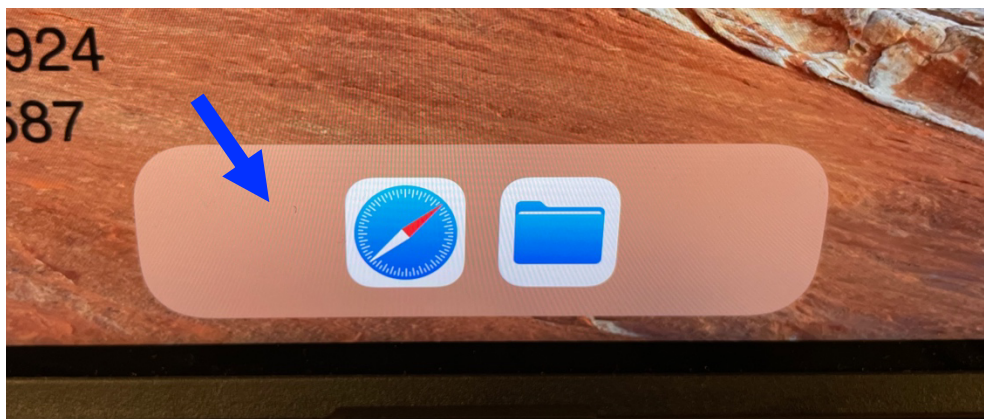
1. Unlock the iPad (passcode: 123456)



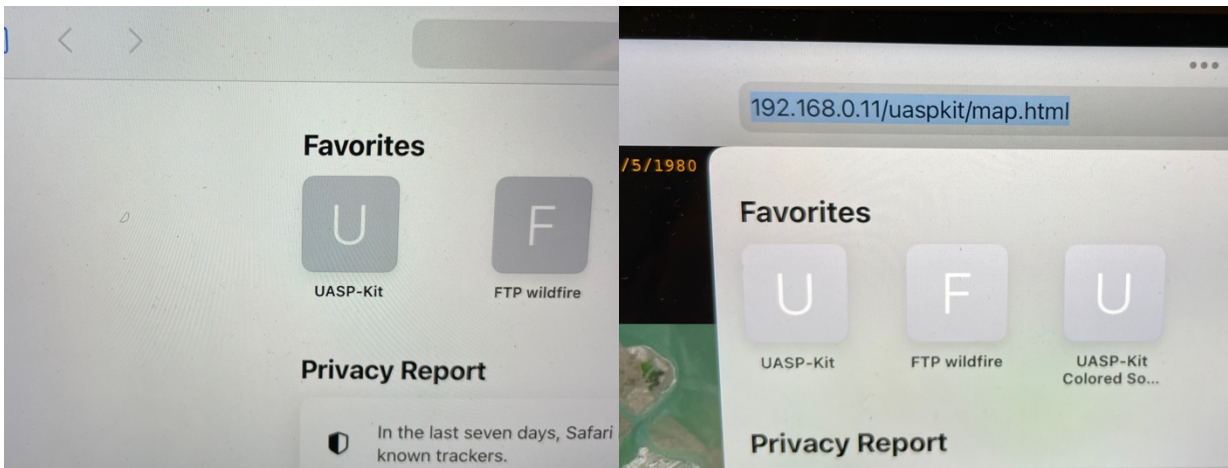
2. Turn up the volume on the iPad all the way using the volume button on the side. You will know the volume is up all the way when you see the volume indication bar at the top of the iPad screen is full.



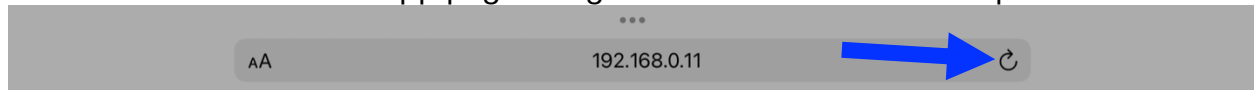
3. Open the Safari application.



4. Navigate to the UASP-kit webapp by using the bookmark (UASP-kit) or by entering in the UASP-kit webapp URL to the address field at the top of the Safari window. UASP-kit webapp URL: 192.168.0.11/uaspkits/map.html

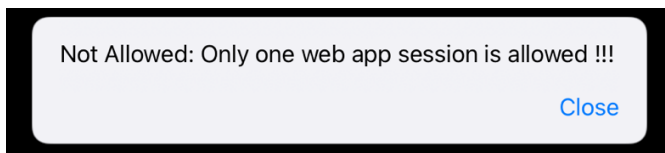


5. Refresh the UASP-kit webapp page using the refresh button at the top of the Safari browser.



6. You know the webapp is running when you hear a BEEP from the iPad.

Important: The UASP-kit only allows one instance of the webapp to be open. This means you cannot have more than one Safari window or tab open with the UASP-kit webapp. If you run into the following error:



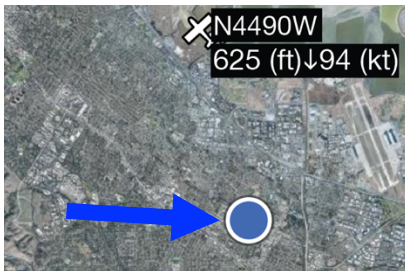
It means the UASP-kit webapp is already open on your iPad. Please close all tabs and Safari windows and try again.

Map navigation

Move: Drag with one finger to move the map left, right, up, or down

Zoom: Pinch with two fingers or use the +/- buttons on the zoom tool to zoom the map in or out

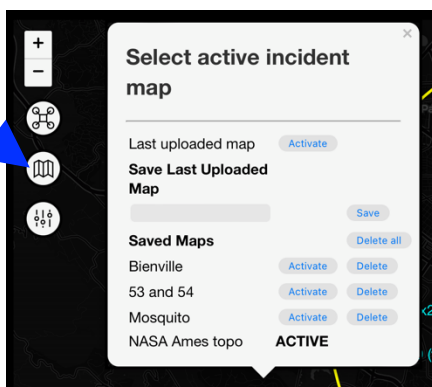
Current location: If the UASP-kit has a GPS connection (indicated at the top in the status bar), a blue dot in your location will appear on the map.



geoPDFs

Activate a saved geoPDF map

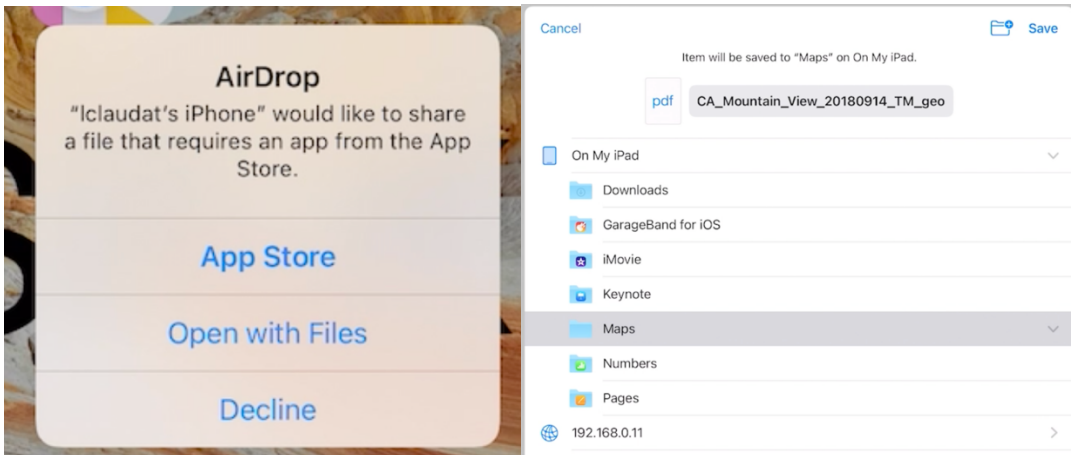
Open the map menu and select ACTIVATE next to the desired map. This will recenter your map over the activated map.



Import a new geoPDF map

To import a new geoPDF map, the UASP-kit webapp must be running. Follow the steps in the Access the UASP-kit's webapp section before trying to import a new geoPDF map.

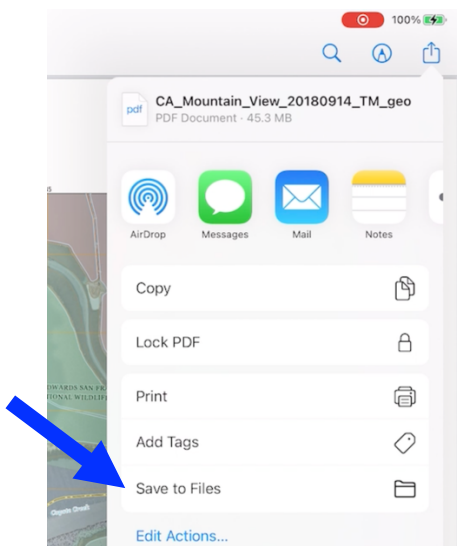
1. Identify the geoPDF you wish to use. Note that the UASP-kit cannot import geoPDF maps from Avenza or Foreflight. These applications use a format that is incompatible with the UASP-kit.
2. On the UASP-kit's iPad, save the geoPDF to the Map folder in the Files application (On My iPad > Map).



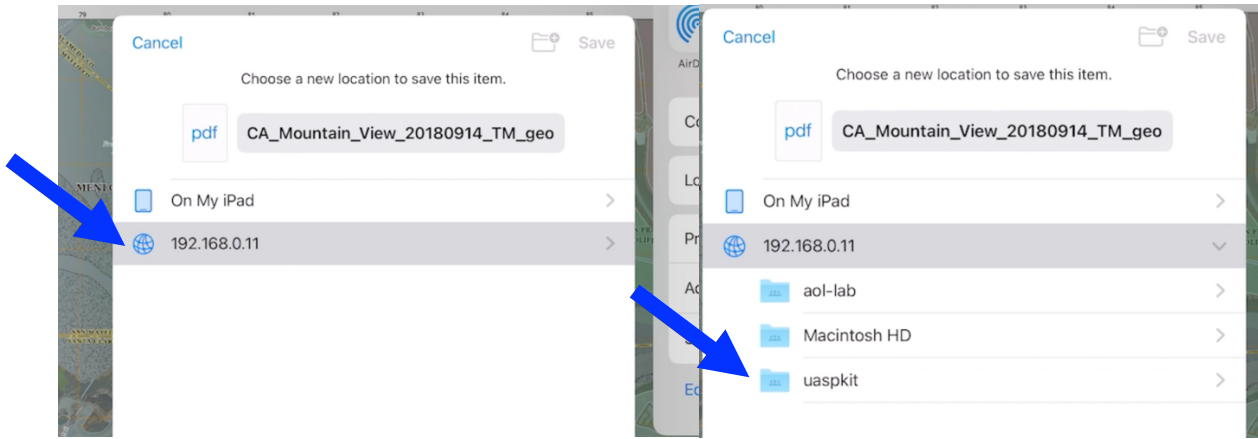
3. In the Files application, open the geoPDF you saved in step 2.
4. Select the share button in the top right of the Files application.



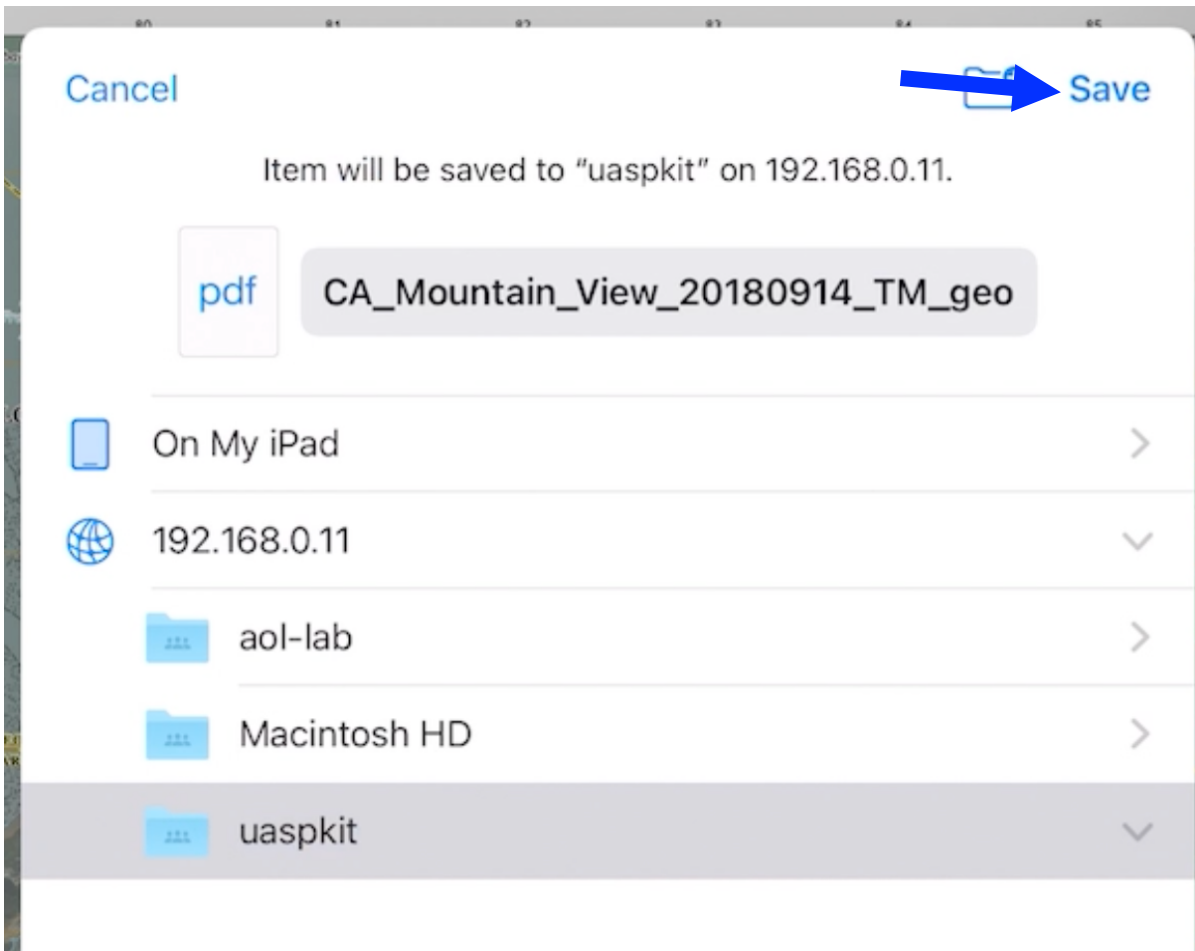
Select the "Save to Files" option.



5. In the dialogue window that appears, select 192.168.0.11 to expand and view the subfolders, then select "uasokit" as the destination folder.

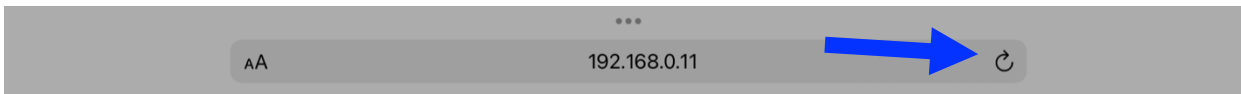


6. The dialogue box should now read “Item will be saved to “uasplit” on 192.168.0.11.”
7. Select [Save](#) in the top right corner of the dialogue box.

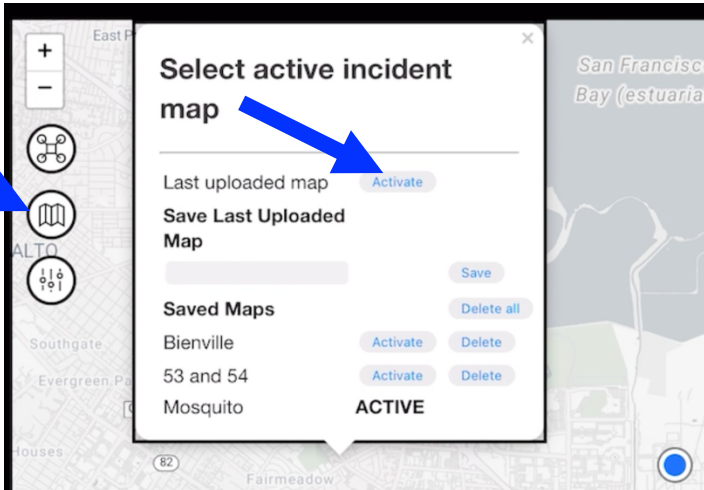


8. Wait and listen for a sequence of beeps from the computer (located inside the internal housing)
 - One BEEP = import started. The UASP-kit sees the new file and has begun the import process.
 - The time you will need to wait depends on the size of the geoPDF you are importing.
 - Two BEEPs = success! The UASP-kit has converted your geoPDF to a map.
 - Four BEEPs = unsuccessful. There was an issue converting your geoPDF.

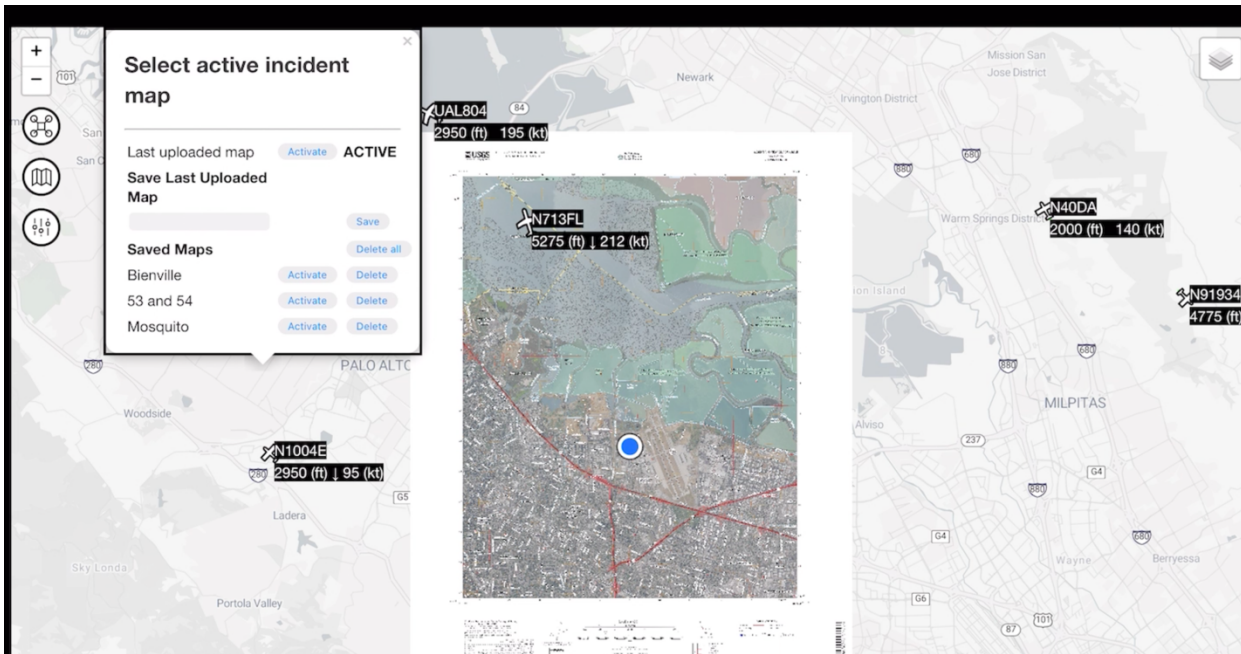
9. After you hear two BEEPs, return to the UASP-kit webapp and refresh the page using the refresh button at the top of the Safari browser. You know the webapp is running when you hear a BEEP from the iPad.



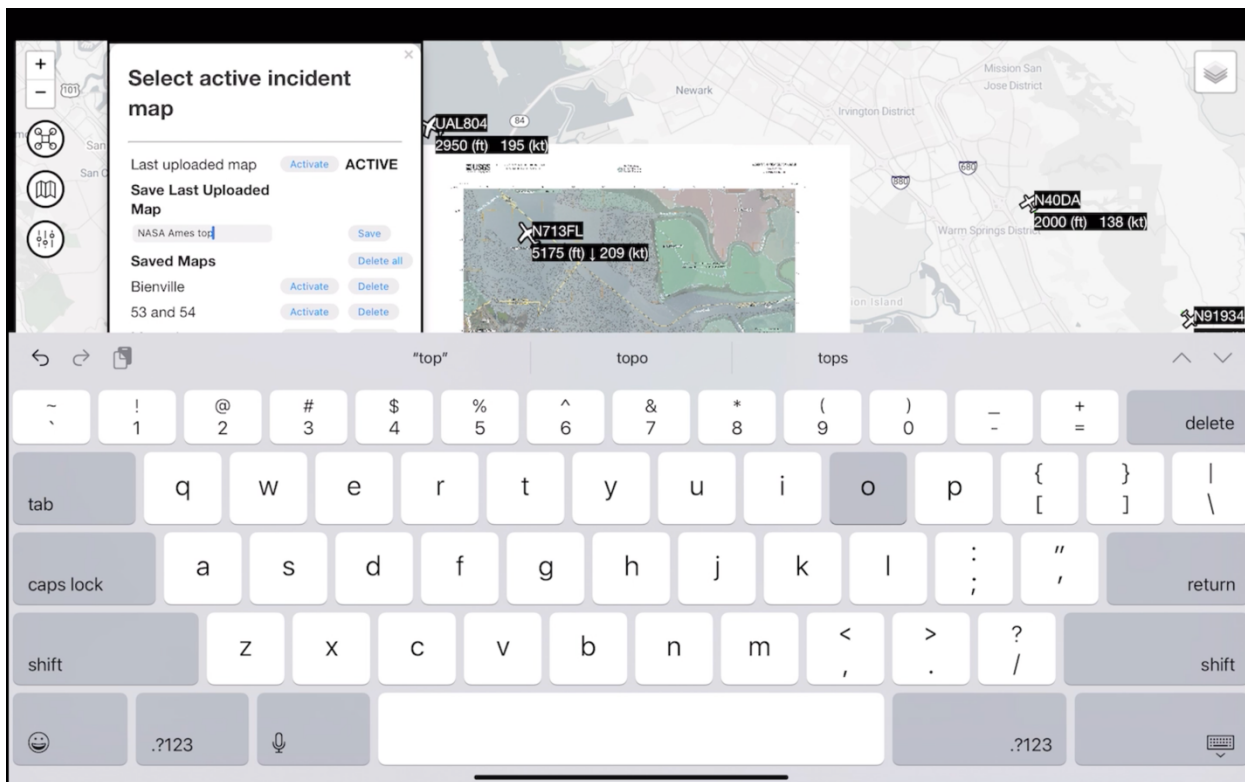
10. Press the map icon to open the Maps panel.



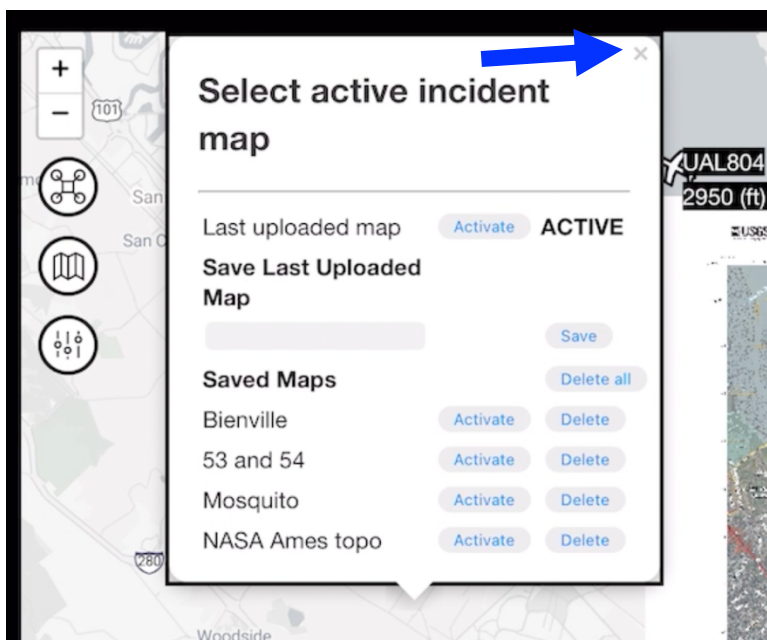
11. Press the “Activate” button next to the “last uploaded map” label. Your screen should now show, and recenter on, the map from step 2.



12. Enter a name of your choice for the new map using the on-screen keyboard and press “save.” Filenames can only contain letters, numbers, and spaces. No special characters allowed.



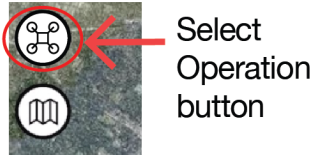
13. Press the grey X at the top right of the screen to close the map panel.



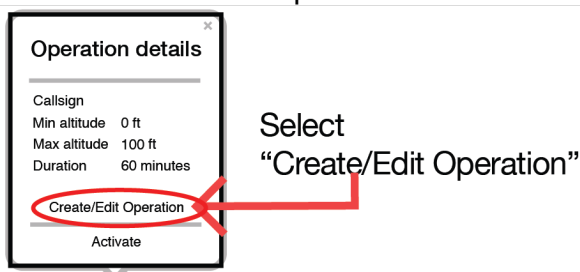
Create an operation

An operational volume virtually outlines the area of airspace in which you intend to fly your UAS, in 4 dimensions. Why should you do this? An operational volume provides the center point for the ADS-B alerting rings. Now all information can be shown relative to your position (presuming you are standing in the center of the volume that you create).

1. Select the Operation button.



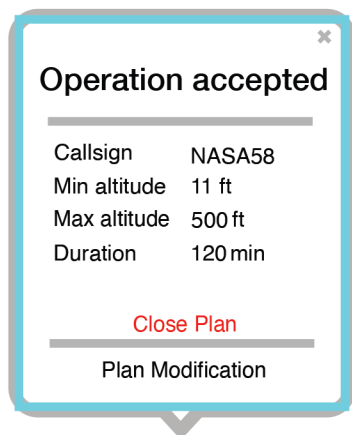
2. Select "Create/Edit Operation"



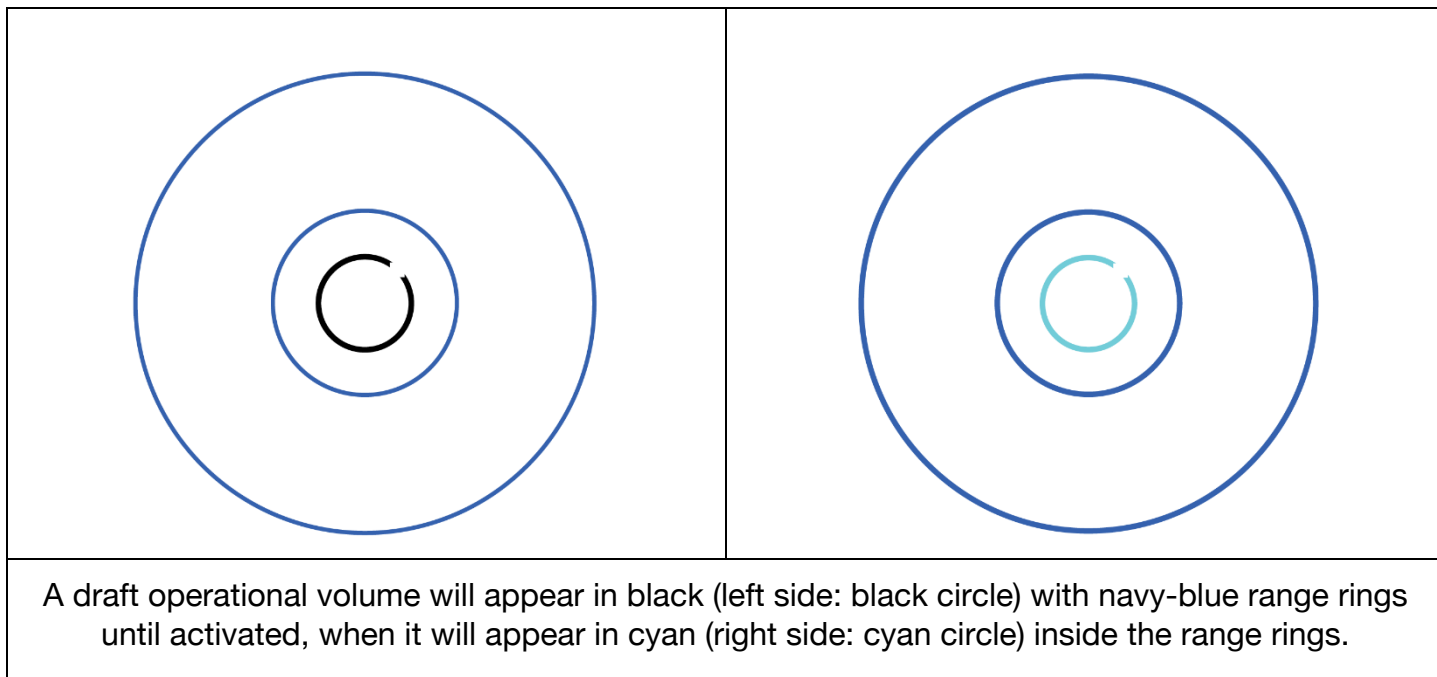
3. Select an operation shape and input your operation information to the Operation setup panel.

If your operation is accepted, proceed to the next section: Define alerts.

Note: If you did not press RETURN after entering values into one of the text boxes, the value you typed will not be saved (you can go back and make changes by selecting Plan Modification)



Example draft vs active operation



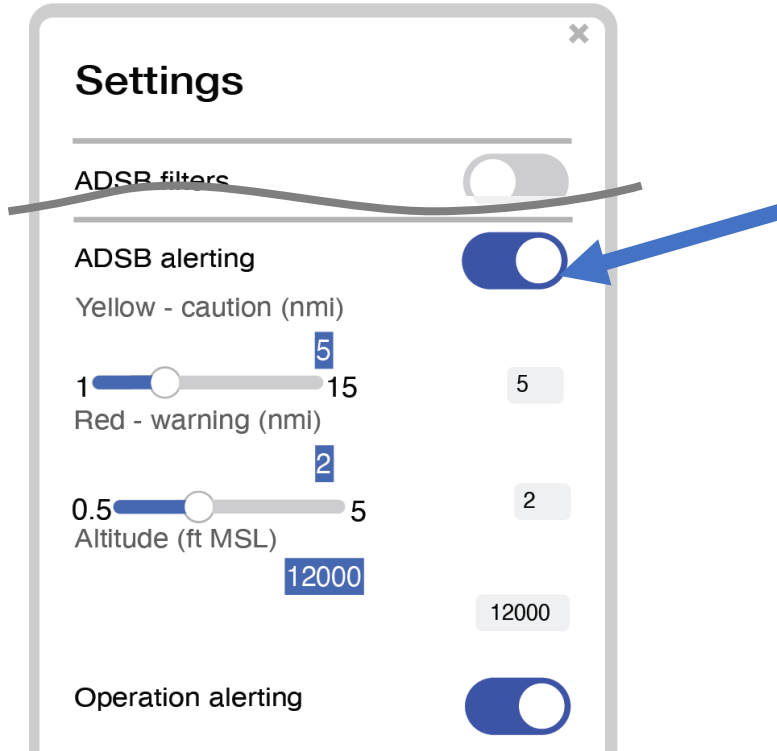
Define Alerts

To receive alerts when ADS-B traffic approaches your operational area, you need to turn the ADS-B alerting on. You can turn the alerting for the range rings on independently of the alerting for your operational volume.

1. Select the “Settings” button.

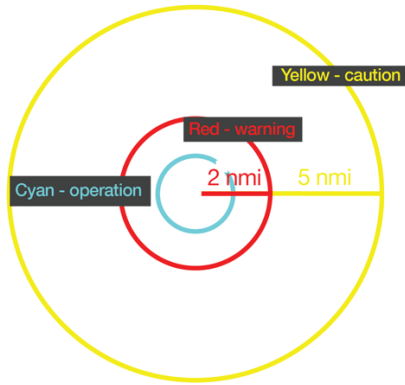


2. To turn the range rings around your operation into alerting rings, toggle on ADS-B alerting. You will hear a preview alert to ensure the sound is turned on.



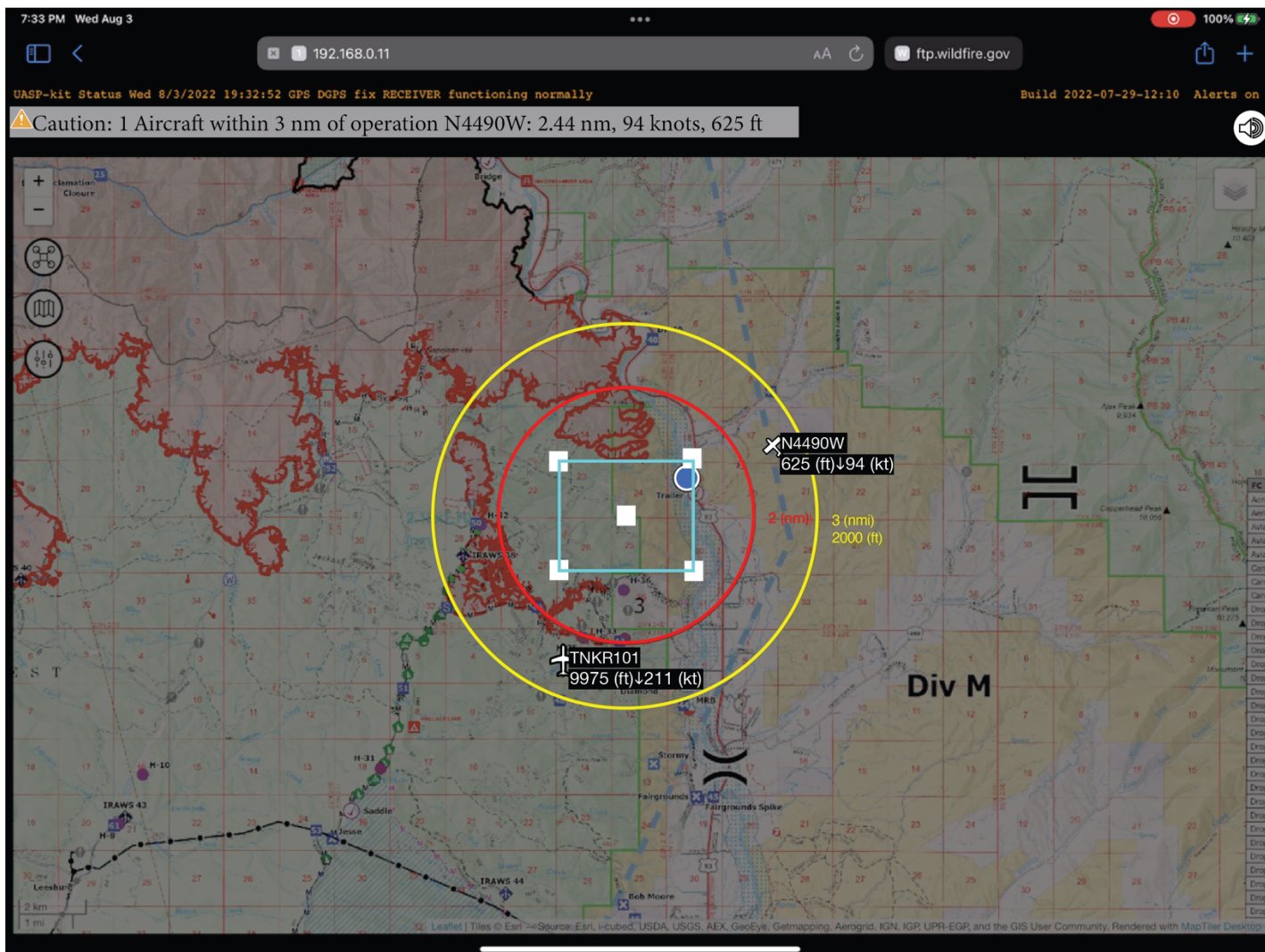
3. Enter the radius you would like for each alert ring and hit return each time. You must hit return for your change to take effect. You will know that you entered a value correctly by looking at the blue current value label under each alert type (Yellow-caution and Red-warning).
4. Enter alert altitude for the range ring areas in ft MSL and hit return. Verify the number you entered is correct by checking the blue current value label under Altitude (ft MSL).
Note: This will alert you of ADS-B tracks that are at or below this altitude within the range rings.
5. **Operation Alerts:** If desired, toggle operation alerting on too. This will alert you of ADS-B-transmitting aircraft that are within the bounds of your operation and at or below your maximum operation altitude. Minimum operation altitude has no effect on alerting.
6. Once you are done, close the Settings panel by selecting the X in the top-right corner.

Alert rings are measured from the center point of your operation for all shape types.



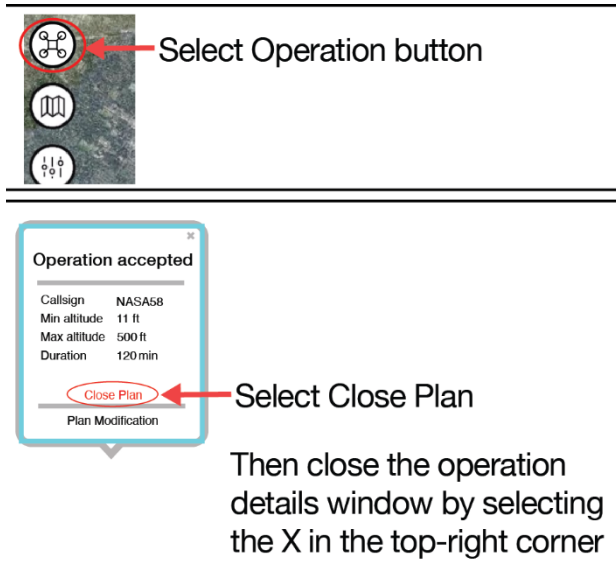
Any time an aircraft (represented by an ADS-B track) crosses either of the alerting rings and is at or below the alert altitude thresholds, it will trigger an alert banner and an alert sound. If you have operation alerting toggled on, any aircraft that crosses into your operation and is at or below your operation's maximum altitude will trigger an alert banner in the black area at the top of the screen and an alert sound. The banner will give the known details about the aircraft, including the distance from the center point of the volume to the aircraft, its callsign, and its speed and altitude if that was transmitted in the ADS-B message.

Aircraft breaching the outer/yellow ring will trigger a "caution" alert that will sound every 30 seconds. If the inner red ring is breached, it will trigger a "warning" alert and it will sound every 5 seconds. If operation alerts are on, an aircraft breaching your operation area will trigger an "urgent" alert and this will sound every second. Pressing the speaker icon in the top black area of the screen will mute the alert sound until a new event occurs.



Shutdown

1. Once you are done using the UASP-kit, close the operation on the webapp.



2. Sleep iPad screen and secure the case over the iPad screen.
3. Unplug power strip from power outlet or from Yeti battery. If using the Yeti battery, press the button marked "AC" to switch it off.
4. Follow the ADS-B receiver setup instructions, but in reverse to stow equipment.
5. Determine if the Yeti battery needs to be put to charge.

Optional

ADS-B filters

Filters allow you to de-clutter your display so that only tracks you are interested in seeing are shown. Currently only the ADS-B data range can be filtered. If you want to see all ADS-B tracks, then you do not need to complete these steps during set up – you are good to go!

Note: aircraft that are filtered out will not trigger alerts. Be sure that your filter values do not conflict with your alert values.



Select Settings button

1. Select the settings button
2. Toggle ADS-B filtering on.
3. Set the distance from the center of your operation (in nautical miles) outside which to filter out ADS-B tracks. In the grey text entry box, enter ADS-B filter range in nmi. Hit return so the value in blue updates. Or use the slider to choose your range.
4. Set the altitude above which you wish to filter out ADS-B tracks. In the grey text entry box, enter the filter altitude in ft MSL. This will filter ADS-B tracks that are at or above this altitude. Hit return so the value in blue updates.
5. Once you are done, close the Settings panel by selecting the X in the top-right corner of the panel.

The screenshot shows a 'Settings' window with a close button (X) in the top right corner. The 'ADS-B filters' section is active, indicated by a blue toggle switch. Below it, the 'Range (nmi)' is set to 15, shown on a slider from 0 to 30 and in a text box. The 'Altitude (ft MSL)' is set to 12000, shown in a text box. At the bottom, the 'ADS-B alerting' section is visible with a greyed-out toggle switch.

ADS-B whitelist

The whitelist allows you to choose a single callsign that will be ignored by the ADS-B alerts. For example, if you are conducting an operation where your UAS will be transmitting ADS-B, whitelisting your own callsign will stop alerts being triggered by your own operation.



Select Settings button

1. Select the Settings button
2. Enter callsign of ADS-B track you wish to whitelist, then select Save.
3. Close the Settings panel by selecting the X in the top-right corner of the entire panel.

To remove from the whitelist

To remove a whitelisted callsign, select Delete.

ADS-B Whitelist

Save

Currently whitelisted callsign:

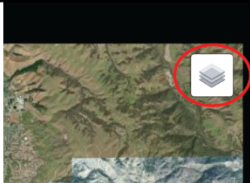
Delete

Change map layers

If you want to change the base map style, or toggle the incident map off:

1

Select the Map Styles button located in the top-right corner of the map



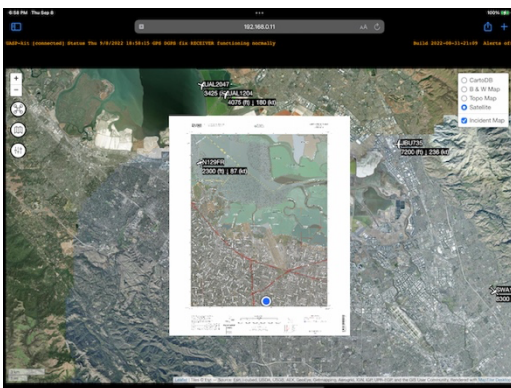
2

Select the radio button next to the map style you want to use.
You can also toggle the Incident Map layer on and off.

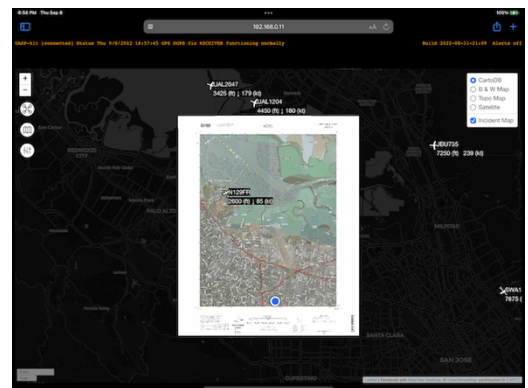
☐ CartoDB
☐ B & W Map
☐ Topo Map
☒ Satellite
☒ Incident Map

When you are done, touch anywhere on the map to close

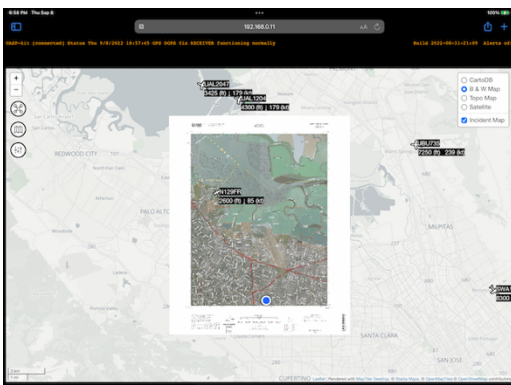
Satellite (default)



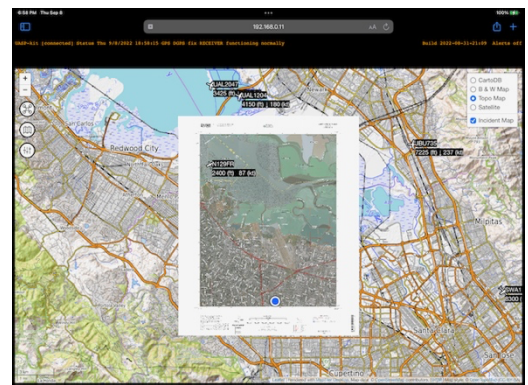
CartoDB



B&W Map



Topo Map



Operation volume shape

This section describes operation volume shapes in more detail. An operational volume provides the center point for the ADS-B alerting rings. A user may also enable alerts for ADS-B tracks that enter within the ownship's operation area. The UASP-kit provides three different options for operation volume shape: circular, rectangular, and polygonal. To create a volume for your own operation, you must first select a volume shape. The shape you selected will appear in the center of your screen. To move the operation volume shape you selected, use the handle (white square) in the center of your operation volume shape. You may also use the handles on the border of the shape to resize it.

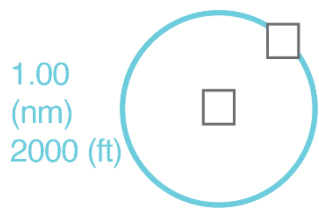
Note: once you select a shape, there is no way to delete or remove the shape from the map. You must complete the operation setup process and then close the operation if you wish to remove it completely.

To complete the operation setup, you must also provide the following information:

- Maximum operation volume altitude in feet MSL (ceiling)
 - this will be used by the operation alerts.
- Minimum operation volume altitude in feet MSL (floor)
- Duration of operation volume in minutes
- Callsign

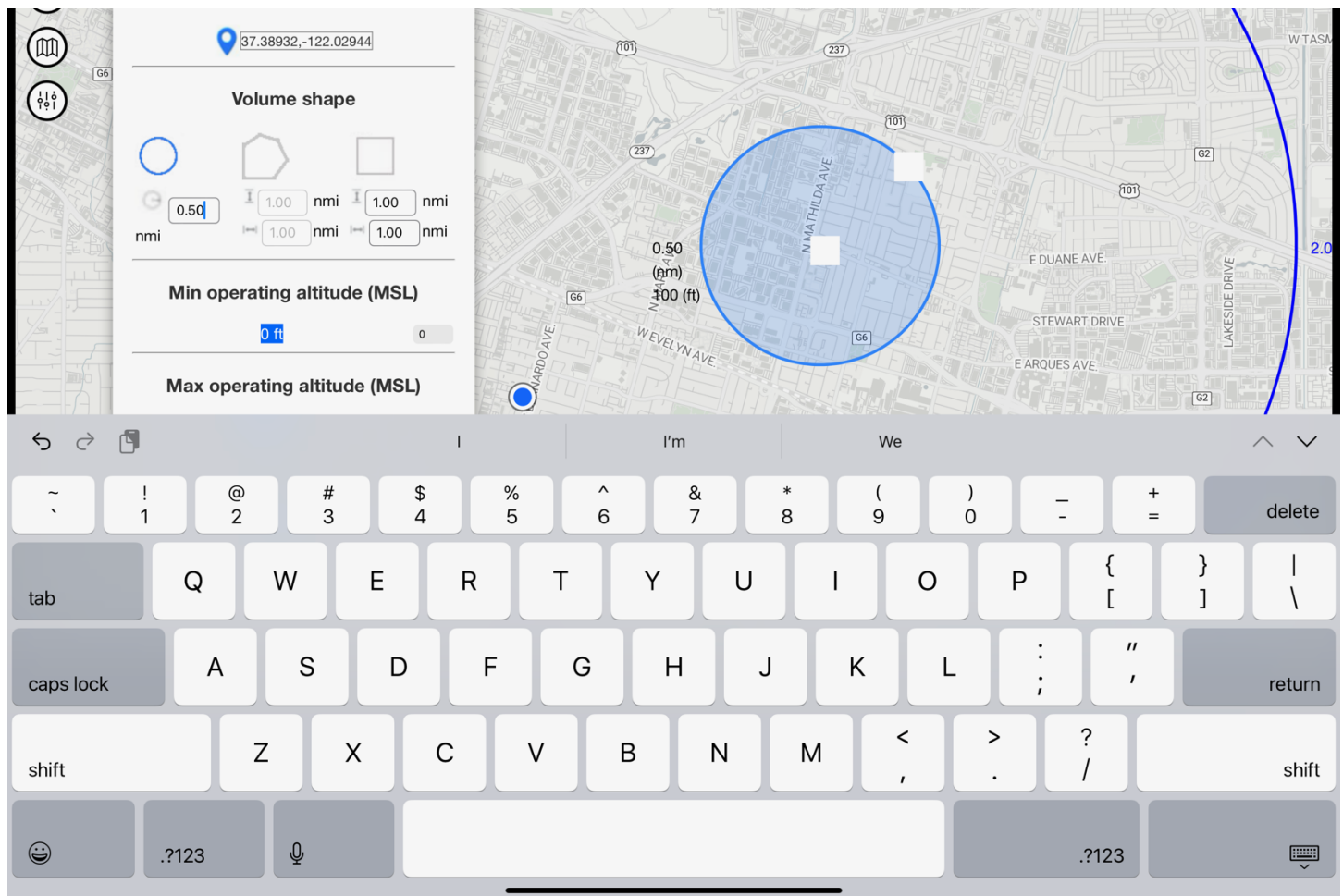
Once you complete your operation setup, close the operation setup window, reopen the operation setup window, and then select "activate." You should see the border of your operation shape turn from black to blue, indicating that it has all the required information, and you are able to proceed with setting up your alerts.

Circle operation

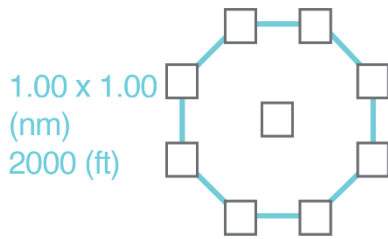


The default circular operation area will have a 1 nmi radius. You may move the circle operation by dragging the handle in the center. You may resize the circle operation by dragging the handle on the border of the circle. The size of the circle operation may be changed in the operation setup menu by entering in a numeric value and hitting return. Note that you can only change the location of the circle operation by dragging the center handle.

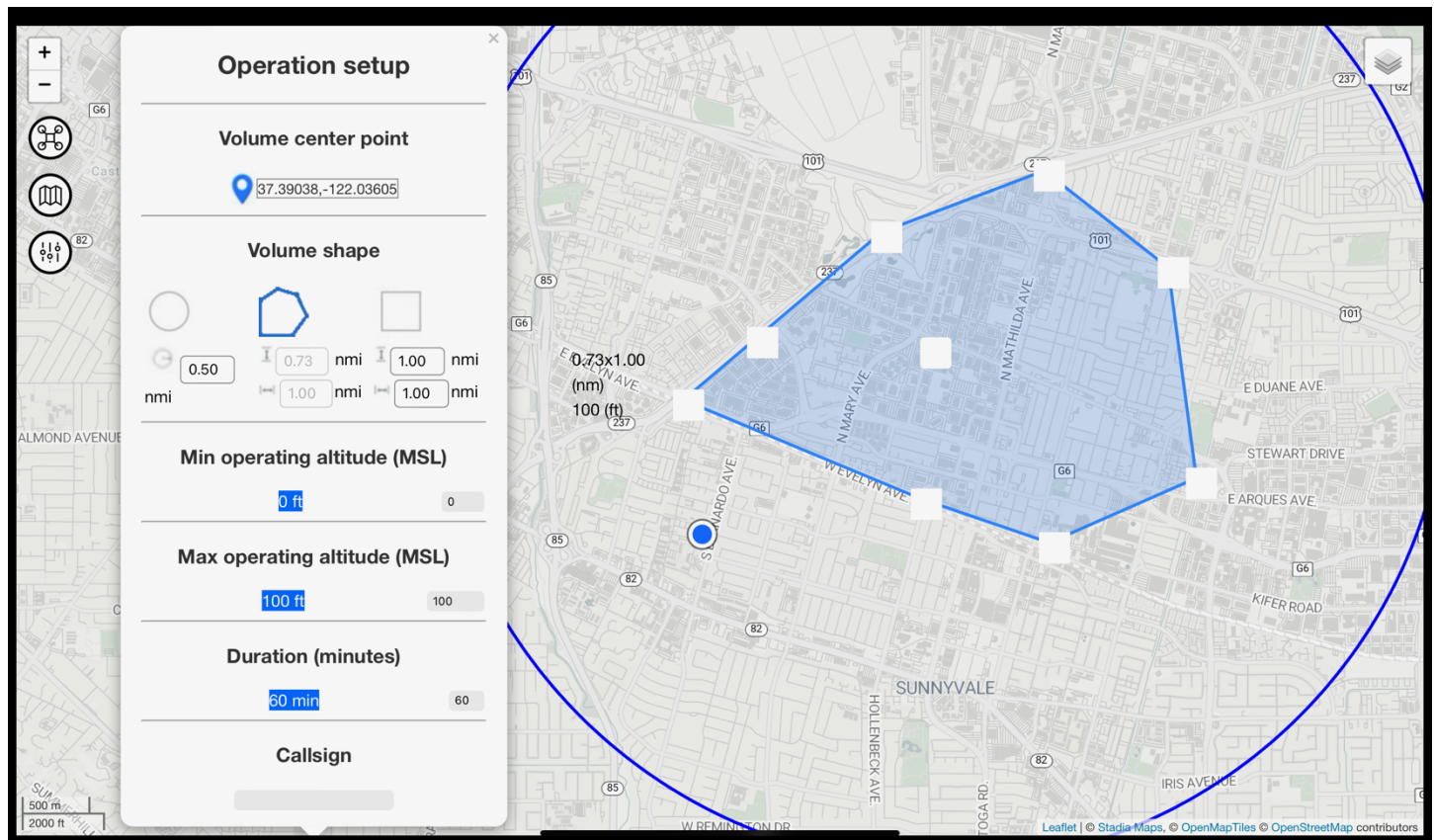
Example of using text entry to change the size of the circle volume shape



Polygon operation



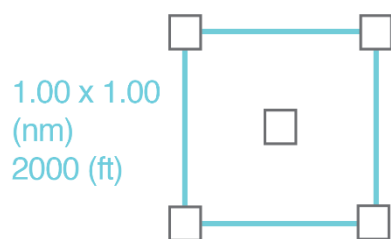
The default polygon operation will be an octagon with a 1 nm radius. You may change the shape of the polygon operation by dragging the handles on the corners of the polygon. As a result, you may have a center handle that is outside of your polygon operation. The center of the polygon operation is found by drawing an invisible box around the entire polygon and finding the center of the invisible box.



The size of the polygon can only be changed by dragging each of the 8 handles the corners of the octagon. The size label for the polygon operation reflects the size of the invisible box drawn around it and represents the distance between furthest points.

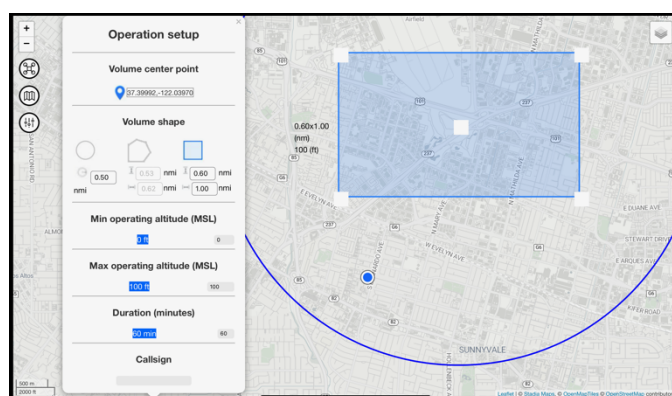
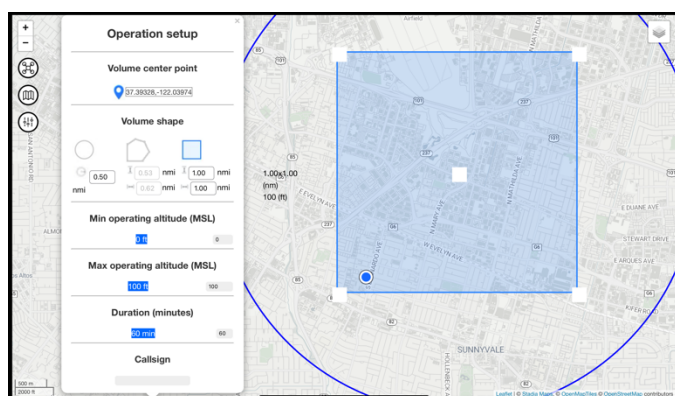
[see example]

Rectangle operation



The default rectangular operation will begin as a square with a 1 nmi radius. You may move the rectangle operation by dragging the handle in the center. You may resize the rectangle operation by dragging the handle on the corners of the square. The length or width of the rectangle operation may also be changed in the operation setup menu by entering in a numeric value and hitting return. Note that you can only change the location of the rectangle operation by dragging the center handle.

Example of two different sized rectangular volume shapes. Note the size label (both the one in blue and on the map) match the operation setup value.

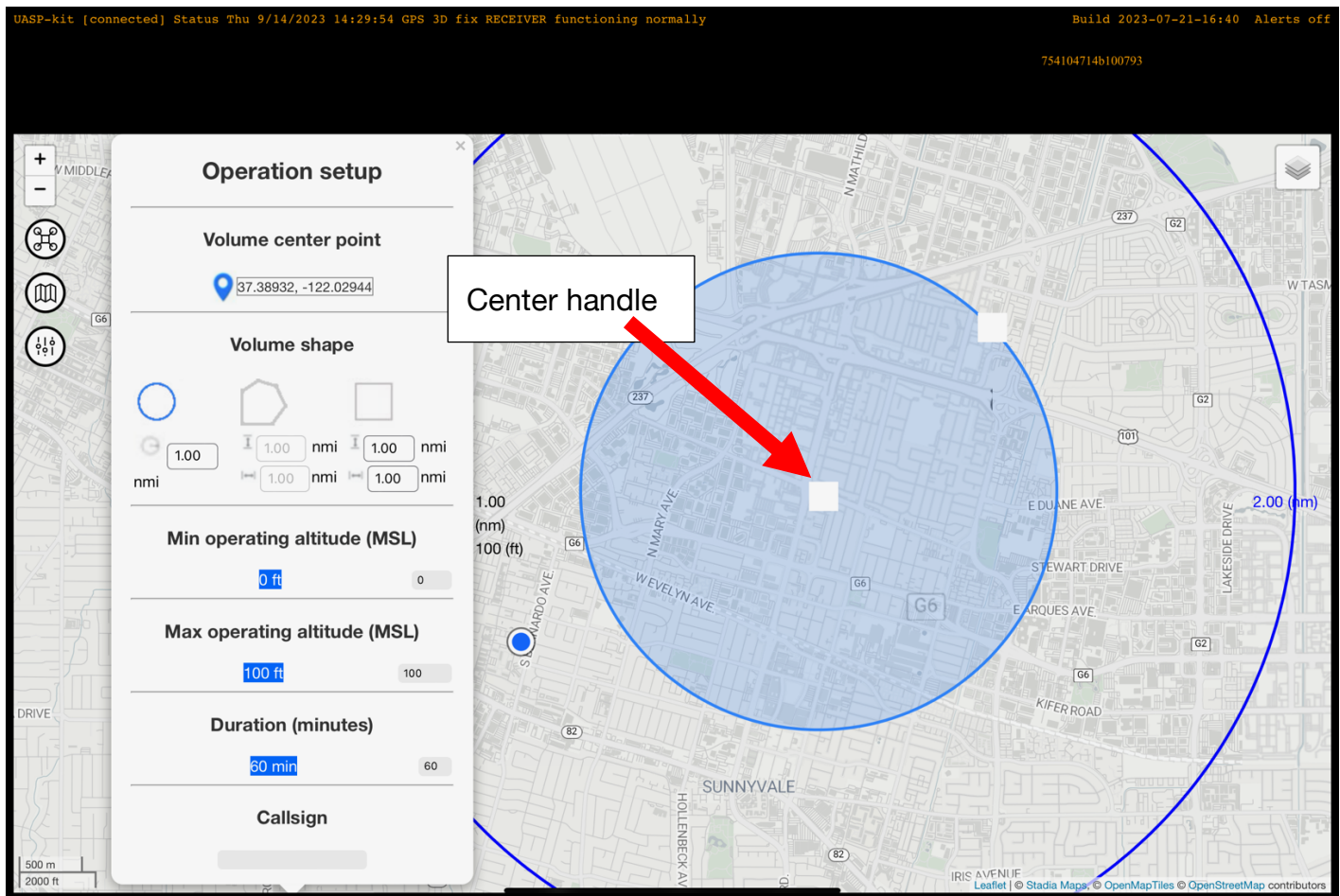


Plan modifications

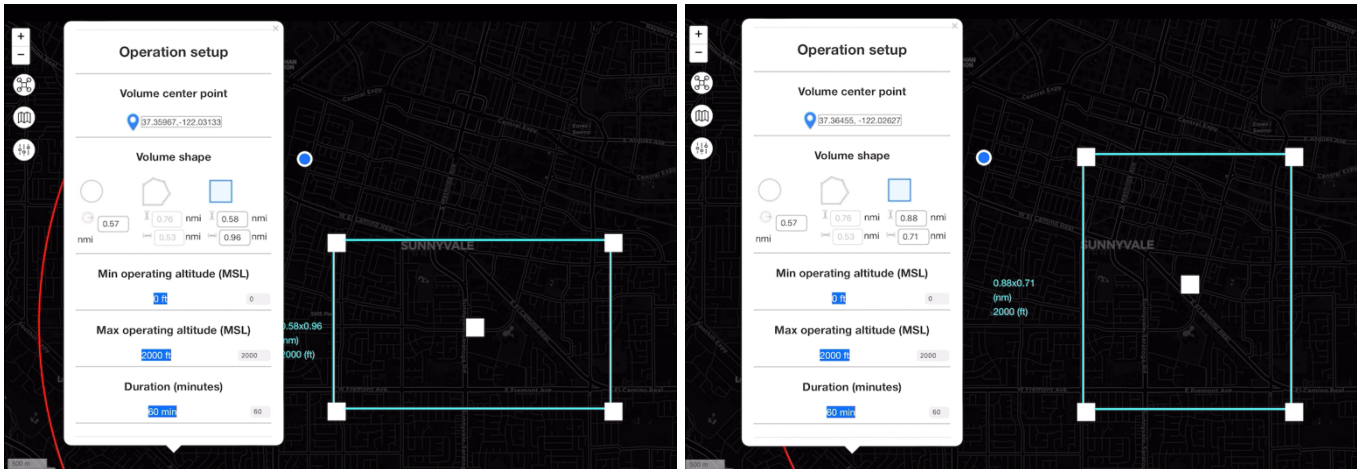
Once you have created an operation, you can make changes to the size, shape, or other operation details. This is useful if you have operation alerts turned on and wish to change the operation maximum altitude, which is used for the operation alerts. To make changes to your current operation, select the Operation button and then select plan modification. This will bring up the operation setup panel.

Modifying the operation center point

You can modify the center of your operation by dragging the handle in the center of your operation. You will see the center point lat/long change as you move the center handle. This is the only way to change the center point of your operation for all volume shapes.



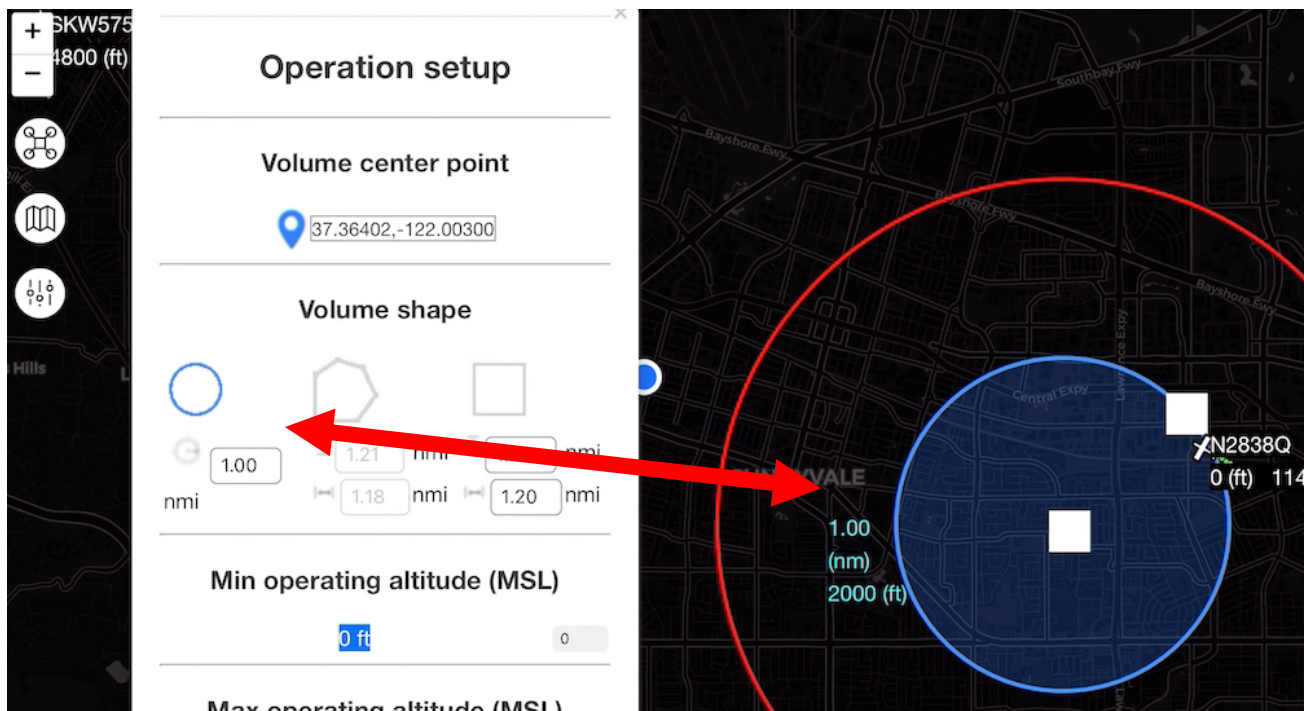
Note that as you change the size of the rectangle or polygon volume shapes, the center will move and the center point lat/long will update accordingly.



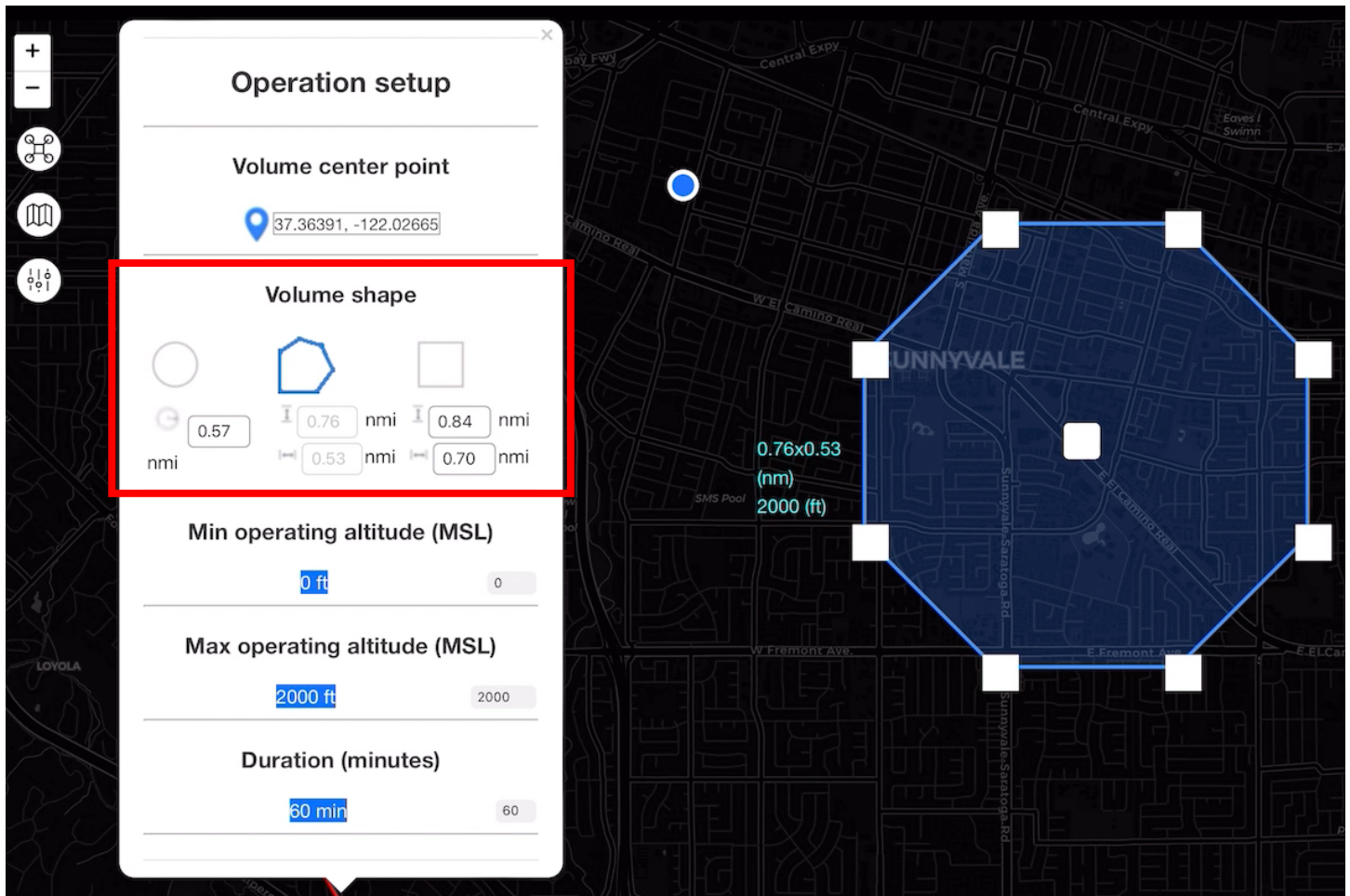
Modifying the operation volume shape and size

You can change the shape of your operation volume by selecting either of the other available shape options. You can also change the size of the volume shape by dragging the handles on the border of your shape.

For the circular and rectangular volume shapes, you can also change their size by using the text entry boxes. This text entry box method is not available to change the size of the polygon shape. Note that if you use the text entry boxes to change the size of either the circle or rectangle shape, you must hit “return” after filling in each value for your change to take effect. You can verify the size change by looking at the operation size label on the map (next to your operation in cyan), which is updated when a new size value is successfully entered.



Another thing to note: if you change the size of your volume shape and then select a different volume shape, the prior size values will persist. This means if you change your mind and re-select the original shape, it will be the same size as you left it but not necessarily with the same center point. In the case of the polygonal volume shape, it will remain the same size but return to the default octagon shape, meaning it will not remember where you moved the handles. If you desire to return any volume shape to all the default values, you must close your current operation and create a new one.



Modifying the operation minimum altitude

You can change the minimum operation altitude to a new value by using the grey text entry box under Min operating altitude (shown in feet MSL) and to the right of the panel. Once you have entered in the new value, you must hit “return” for your change to take effect. In the operation setup panel, you can verify your change by looking at the value in the blue “current value” label under Min operating altitude. You can also verify your change is in effect in the operation details panel by closing the open “Operation setup” panel (select the grey X in the top right corner of any open panels) and then re-selecting the operation button to bring up the operation details panel. You should see “Operation accepted” at the top and Min altitude listed below with your new value displayed. If at first you do not see your change, with the operation detail panel still open select the operation button again to refresh the panel. If you still do not see the changes, you will need to select plan modification and make your change again, hitting return.

Modifying the operation maximum altitude

The operation's maximum altitude is used to trigger any alerting, so you may wish to change this value to better suit your situation. You can change the maximum operation altitude to a new value by using the grey text entry box under Max operating altitude (shown in feet MSL) and to the right of the panel. Once you have entered in the new value, you must hit “return” for your change to take effect. In the operation setup panel, you can verify your change is in effect by looking at the value in the blue current value label under Max operating altitude. You will also see the maximum operation altitude label on the map (next to your operation in cyan) update. You can also verify your change is in effect in the operation details panel by closing the open “Operation setup” panel (select the grey X in the top right corner of any open panels) and then re-selecting the operation button to bring up the operation details panel. You should see “Operation accepted” at the top and Max altitude listed below with your new value displayed. If at first you do not see your change, with the operation detail panel still open select the operation button again to refresh the panel. If you still do not see the changes, you will need to select plan modification and make your change again, hitting return.

Modifying the operation duration

You can change the operation duration to a new value by using the grey text entry box under Duration (minutes) and to the right of the panel. Once you have entered in the new value, you must hit “return” for your change to take effect. In the operation setup panel, you can verify your change is in effect by looking at the value in the blue current value label under Duration (minutes). You can also verify your change is in effect in the operation details panel by closing the open “Operation setup” panel (select the grey X in the top right corner of any open panels) and then re-selecting the operation button to bring up the operation details panel. You should see “Operation accepted” at the top and duration listed below with your new value displayed. If at first you do not see your change, with the operation detail panel still open select the operation button again to refresh the panel. If you still do not see the changes, you will need to select plan modification and make your change again, hitting return.

Modifying the operation callsign

You can change the operation callsign to a new value by using the grey text entry box under Callsign. Once you have entered in the new value, you must hit “return” for your change to take effect. Note that if you used any lower-case letters, they will automatically become upper-case when you hit “return”. You can verify your change is in effect in the operation details panel by first closing any open panels (select the grey X in the top right corner of any open panels) and then re-selecting the operation button to bring up the operation details panel. You should see “Operation accepted” at the top and Callsign listed below with your new value displayed. If at first you do not see your change, with the operation detail panel still open select the operation button again to refresh the panel. If you still do not see the changes, you will need to select plan modification and make your change again, hitting return.

Alerting

This section describes the UASP-kit alerting functions in more detail. The UASP-kit offers two alert types the user can enable and configure: Range ring alerts and operation alerts.

Alerting basics

When enabled, the UASP-kit will alert for ADS-B tracks that are within the bounds of the alert shape and at or below the alert altitude. This logic is used by all alert types.

There are a few ways an aircraft that meets the above definition would not trigger an alert:

- If the callsign of the ADS-B track is on the whitelist
- If the ADS-B track is filtered out

It is a good practice to check that your ADS-B filter parameters are not filtering ADS-B tracks that you wish to receive alerts for. This can happen if the filtering altitude is below your alert altitude or your filter distance value, measured point-radius from the center of your operation, is smaller than your largest alert ring size.

Secondly, you should also check that there are either no aircraft or only the desired callsign on the whitelist.

Finally, a minimum altitude cannot be set for any alert type. Your operation minimum altitude will not be used for operation alerts.

Note for when a base and remote station are connected:

You will not receive alerts for aircraft that have “N/A” for altitude. This is because we have received a valid position report (i.e., ID/callsign and lat/long), but not a valid altitude. Besides this, alerting for ADS-B track received by the remote station will behave normally.

For each alert type, the corresponding alert banner will list the number of aircraft currently triggering the alert and the callsign, speed, heading, and distance from the center of your operation of the closest aircraft nearest ADS-B track (for that alert type).



Each alert type has a corresponding tone and an interval at which it will sound. In the event you have more than one alert type triggered, the UASP-kit will display all alert banners, but only emit the highest priority alert tone. This table summarizes the alert tones and priority:

Alerting	
Priority (lower number indicates higher priority)	
1 Operation Alert - Urgent	
Sound	Three tones then "urgent urgent"
Frequency	1 sec
Range Ring Alerts	
2 Red/Warning	
Sound	Two tones then "warning"
Frequency	5 sec
3 Yellow/Caution	
Sound	Two different tones then "caution"
Frequency	30 sec

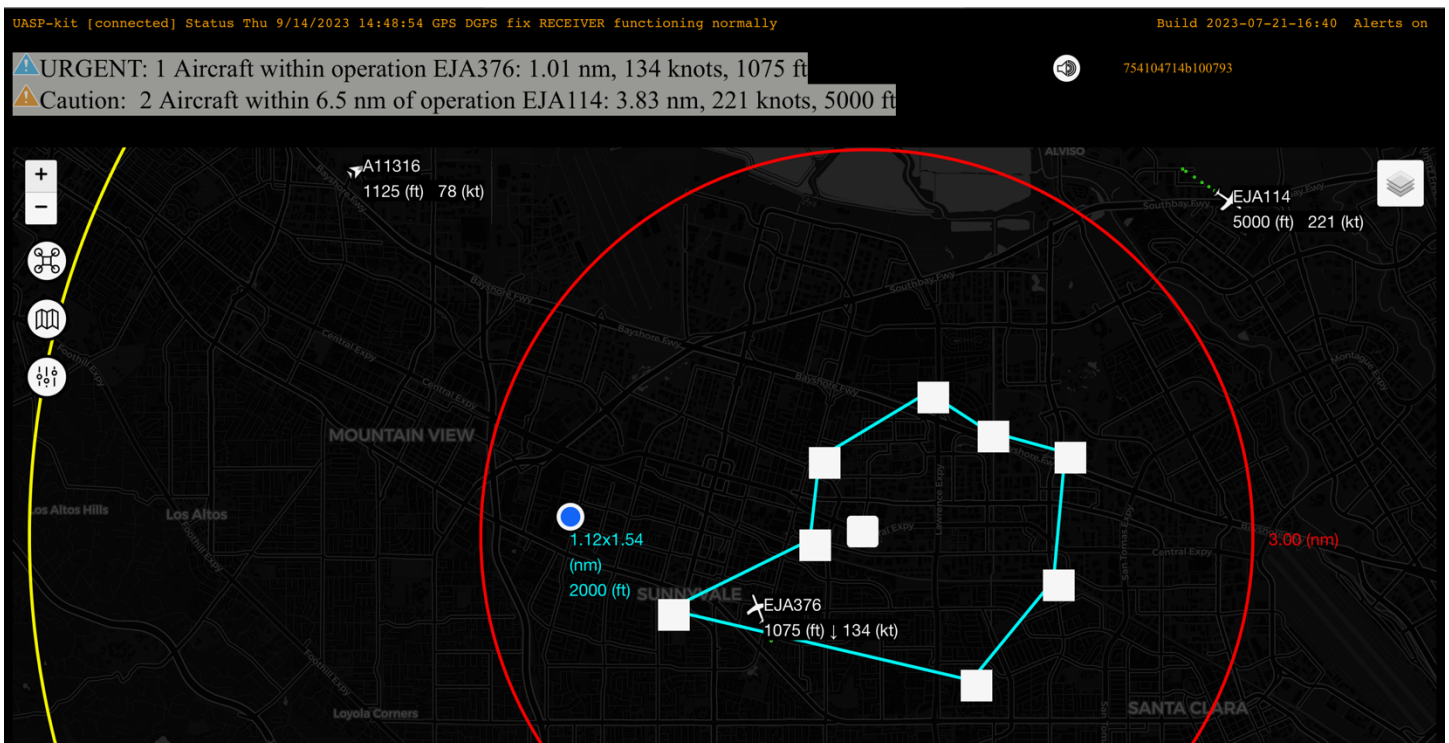
Range ring alerts

The range ring alerts give two levels of alerting, yellow caution and red warning, for ADS-B tracks that come within a defined distance and altitude from the center of your operation. You can define the size, measured in point-radius from the center of your operation, of each alert ring and the alert altitude, measured in feet MSL, used by both. There are a few constraints enforced for the alert rings:

- The yellow caution ring cannot be made smaller than the red warning ring.
- The red warning ring cannot be made smaller than your operation.
 - This constraint can be violated when using a square/rectangle or polygon operation shape, where the corners may extend beyond the bounds of the alert rings.
- Both the yellow caution and red warning alerts will use the same altitude (you cannot set a different alerting altitude for each).

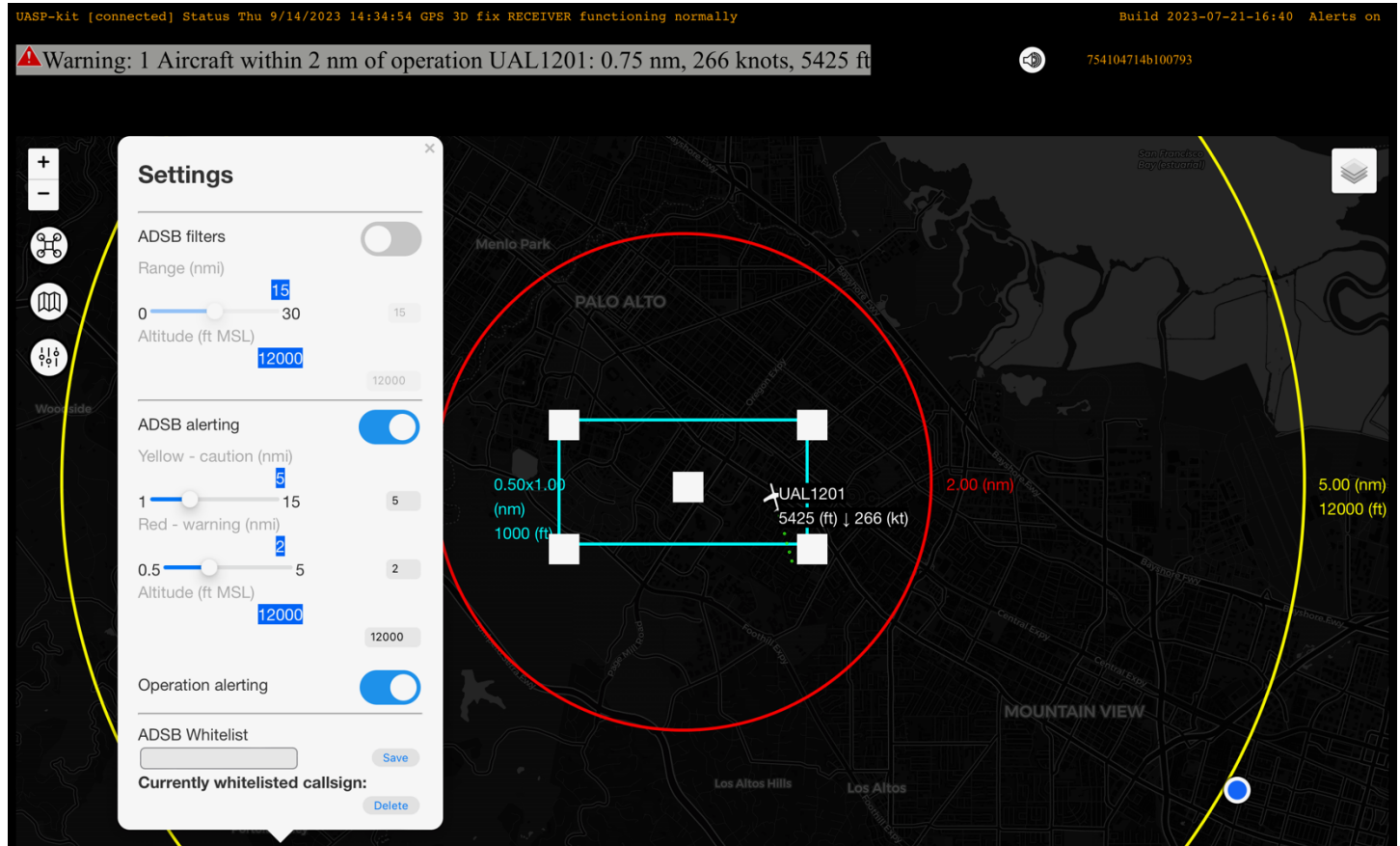
Operation alert

The operation alert is a third alerting boundary that can be enabled separately from the range ring alerts. When enabled, the operation alert will sound when an ADS-B track comes within the bounds of your operation and is at an altitude equal to, or less than, your maximum operation altitude.



Operation alerts follow the parameters of your operation.

Note that if you use a higher alerting altitude for the range ring alerts than the operation alert, you may see ADS-B tracks that are setting off the red warning alerts within the lateral bounds of your operation but are above the operation alert altitude. You will only receive operation alerts when an ADS-B track enters the bounds of your operation shape AND are at or below the maximum operation volume altitude. Minimum operation altitude is not used for alerting.



Remote and Base Station

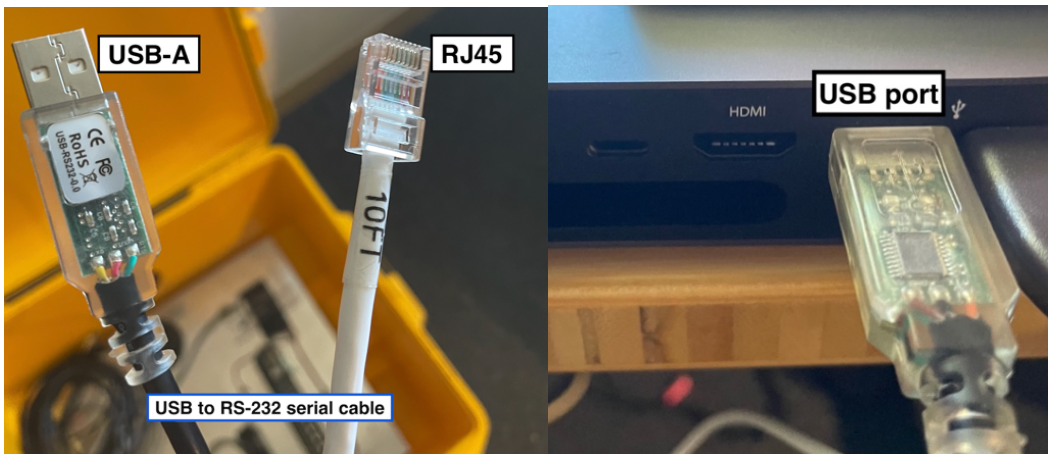
With a remote and base station, the UASP-kit can receive ADS-B messages from a second, remotely positioned ADS-B receiver. With optimal placement, such as at the top of a hill and within line-of-sight of the base station, the UASP-kit is able to take advantage of a much wider viewshed of the airspace. The ADS-B receiver in the remote station will relay ADS-B tracks it receives to the base station, and on to the UASP-kit. The UASP-kit fuses the ADS-B tracks from the remote station with the ones it receives from its own local ADS-B receiver (the one that comes in the UASP-kit box). You can tell when a remote station is successfully sending ADS-B messages to your UASP-kit when you see a second source displayed in the status banner and the USB from the connected base station is flashing green.

Base station – QuickStart guide

Set up base station pelican case so that it is next to the UASP-kit.



1. Locate the black **coaxial feeder cable**.
 - 1a. Connect one end to the **ANT port** on the **4RF radio**.
 - 1b. Connect the other end to the large white **antenna**.
2. Locate the **USB to RS-232 serial cable**.
 - 2a. Connect the RJ45 end into the **SERIAL 1** port on the **4RF radio**.
 - 2b. Connect the USB dongle end into a USB port on the UASP-kit mac mini.



3. Connect the grey power plug into the UASP-kit yeti (or other power source) to power on the base station.
4. Mount the large white **antenna** upright and away from obstructions so that it has a clear view of the sky.



Confirm that the base station is correctly set up and ready to receive data:

You should see the following combination of LED colors and patterns:

OK, MODE, AUX = solid green – indicates that the radio is in an operational state

TX, RX = flashing green – indicates that the base station is actively communicating with the remote station



Confirm the following combination of LED colors and patterns:

SERIAL 1 port (left LED) = solid green – indicates connection to the UASP-kit

SERIAL 1 & 2 ports (right LEDs) = alternate flashing orange – indicates data is being shared by the remote station



Confirm the UASP-kit is receiving incoming data from the base station:



flashing green = data is actively being shared with

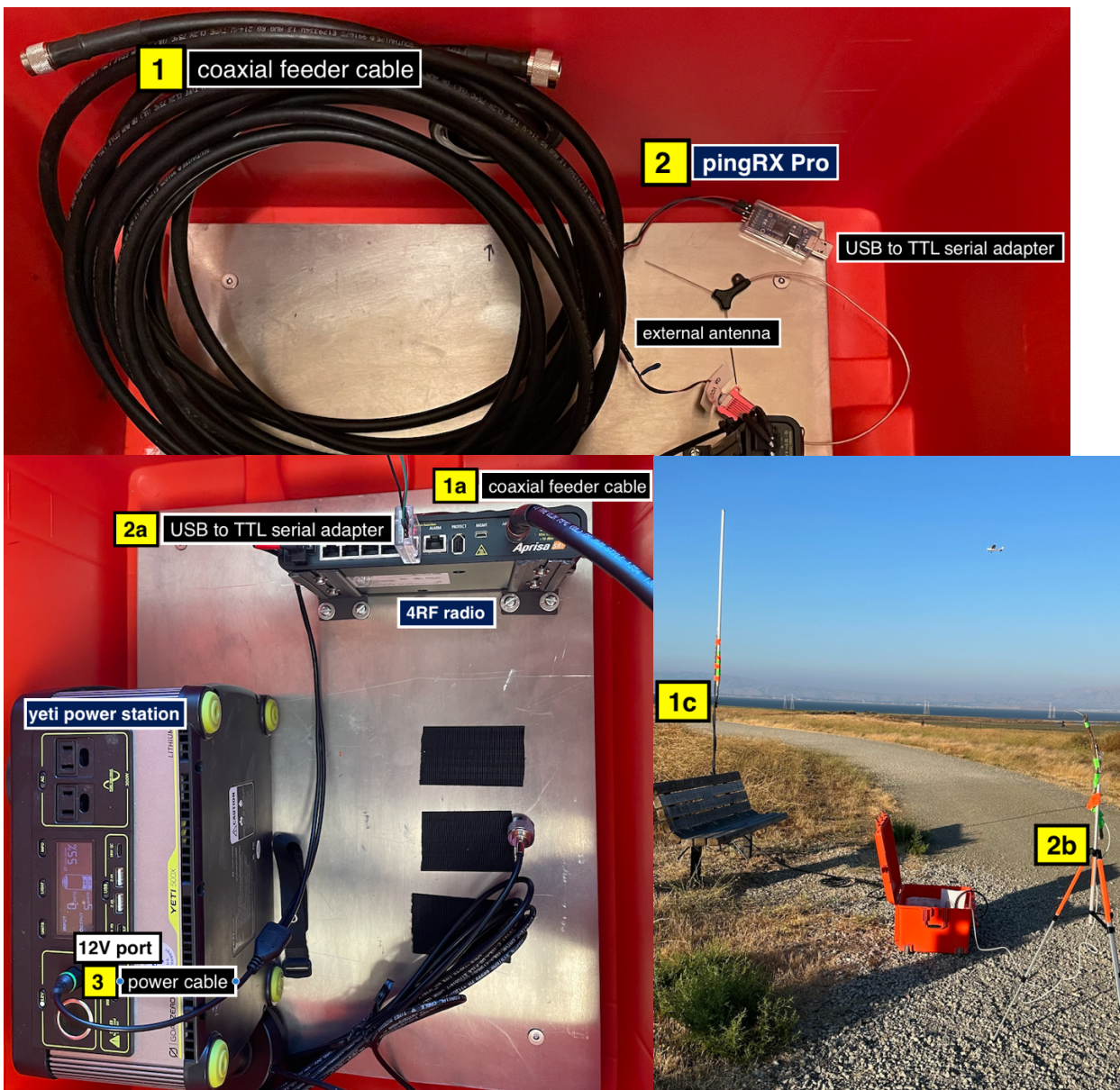


Second source is listed in the status bar of the UASP-kit when the remote station is connected and the UASP-kit is receiving data.

Remote station – QuickStart guide

Set up remote station pelican case in a different area from the UASP-kit and base station.

1. Locate the black **coaxial feeder cable**.
 - 1a. Connect one end to the **ANT** port on the **4RF radio**.
 - 1b. Connect the other end to the large white **antenna**.
 - 1c. Mount the large white **antenna** upright and away from obstructions so that it has a clear view of the sky.
2. Locate the **pingRX Pro**
 - 2a. Connect the USB to TTL serial adapter end to USB port on the **4RF radio**.
 - 2b. Mount the **pingRX Pro** external antenna upright and away from obstructions so it has a clear view of the sky.
3. Connect the **4RF radio power cable** into **12V port** on the yeti power station and power on.

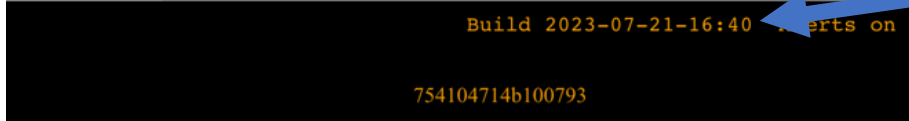


Updating the UASP-kit Software

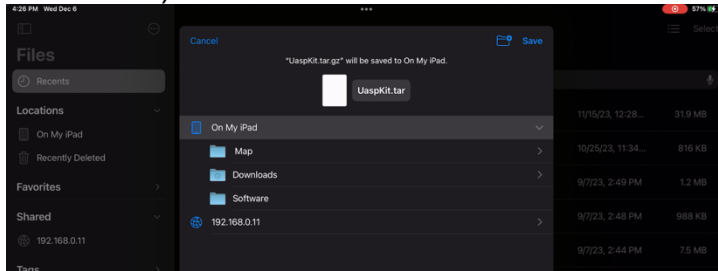
If you are running a version of the UASP-kit that is “Build 2023-07-21-16:40” or later, you can update the UASP-kit software through the connected tablet with a method similar to that of uploading new geoPDFs.

In order to update the UASP-kit software, you will receive a file named “UASP-Kit.tar.gz”. Your UASP-kit must be turned on and running in order for you to update the software.

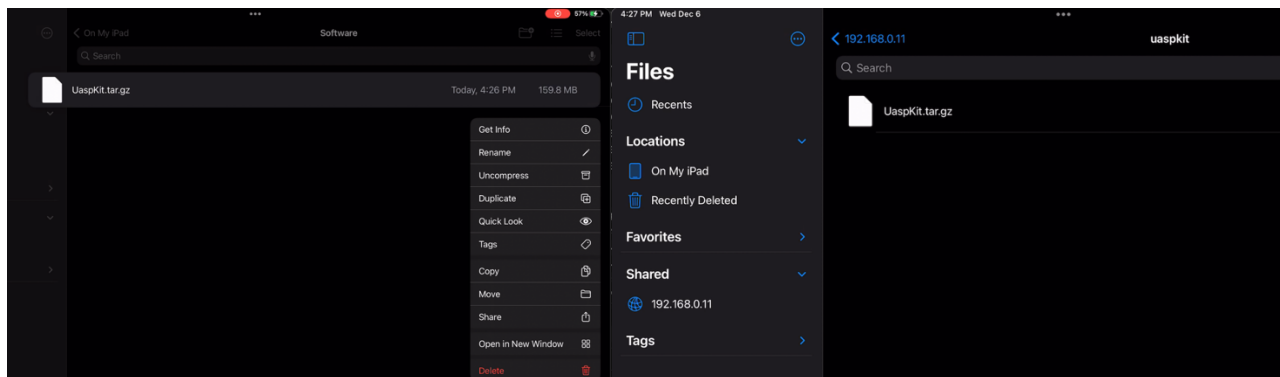
1. Follow the startup procedures to turn on your UASP-kit.
2. Make a note of your UASP-kit’s current build date and time, which is located in the UASP-kit webapp in the top-right side of the status bar.



3. Quit Safari on the UASP-kit’s iPad.
4. In the Files application on the iPad, put the “UASP-Kit.tar.gz” file in the Software folder (Files > Software).

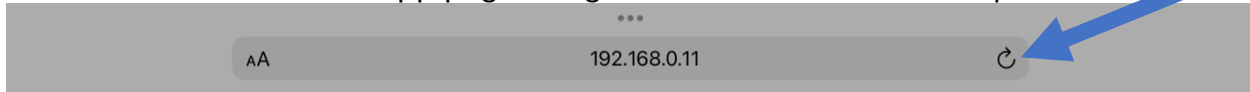


5. Open the iPad’s settings menu.
6. Clear the Safari cache on the iPad (Settings > Safari > Clear History and Website Data).
7. Open the Files application.
8. Copy "UASP-Kit.tar.gz" file from Software folder to the uaspkit folder (192.168.0.11 > uaspkit).

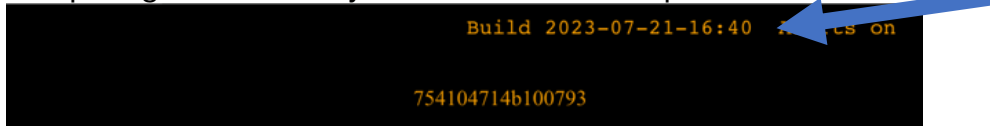


- After several (~30) seconds you will hear a BEEP from the computer. This means the software upgrade process has started.
- After a few minutes, you will hear two BEEPs from the computer. This means the software upgrade is complete.

9. Once you hear two BEEPs from the computer, open Safari.
10. Navigate to the UASP-kit webapp by using the bookmark (UASP-kit) or by entering in the UASP-kit webapp URL to the address field at the top of the Safari window.
11. Refresh the UASP-kit webapp page using the refresh button at the top of the Safari browser.



12. Verify a new build date and time is displayed in the top-right side of the status bar by comparing it to the one you wrote down in step 2.



Troubleshooting

Below is a list of problems users have encountered that they can often fix themselves.

[Known issue] iPad says it cannot connect to the internet, even though the UASP-kit has been turned on and I waited five minutes.

- Check that all components in the UASP-kit are plugged into the power strip.
- Check that the LTE router is connected to the Mac Mini via ethernet cable.
- Check that the iPad is connected to the Mac Mini via USB-C cable.
- Once checks are complete, do the following:
- Unplug the iPad from the Mac Mini and plug the iPad back into a different USB-C port on the Mac Mini
- Refresh the UASP-kit webapp.

If you are successful, the UASP-kit webapp will load and you will hear a “BEEP” sound.

If you still encounter the error, do the following:

- Keep the iPad plugged into the Mac Mini and the UASP-kit powered on
- Power cycle JUST the iPad
- Unlock the iPad and navigate to the UASP-kit webapp.
- Refresh the UASP-kit webapp.

If you are successful, the UASP-kit webapp will load and you will hear a “BEEP” sound

Lack of any/all ADS-B traffic

Cable is unplugged.

- Check both ends: all components in the UASP-kit are plugged into the power strip.
- Check both ends: the ADS-B receiver is connected to the PoE via ethernet cable.
- Check both ends: the PoE is connected to the LTE router via ethernet cable.
- Check both ends: the LTE router is connected to the Mac Mini via ethernet cable.

ADS-B tracks are filtered out.

- Check ADS-B data filters are not set to be really close in (or at 0).

There are no aircraft within line-of-site of the ADS-B receiver antenna.

- Move the antenna where it has a clear, open view of the sky
-

iPad stops working.

iPad battery needs charging.

- The iPad receives power from the Mac Mini. If the UASP-kit has not been turned on in a while, you may need to let the iPad charge by turning on the UASP-kit and letting the iPad charge through its connection to the Mac Mini
 - Note: It is not recommended to unplug the iPad from the Mac Mini.

iPad is too hot/too cold.

- The iPad seems to be the component of the UASP-kit that is the most sensitive to temperature changes (cold and heat). It may stop working at temperatures below freezing or above 100°C.
- To prevent overheating, keep the iPad out of direct sunlight, preferably in the shade.
- If the iPad gets too hot, move the UASP-kit to a cooler location (e.g., in the shade) until the error message goes away.
- To prevent getting too cold, keep the UASP-kit in a warmer environment, similar to one where you would keep LiPo batteries.

Can't activate an operation volume.

"Operation set up" panel is incomplete.

- All the fields on the "Operation set up" panel need to be filled out in order to activate the volume – that is, shape of volume, height, duration, and callsign.

Note: Volumes have default values for width/radius, height, and duration that the UASP-kit will accept, but you have to select/ enter volume shape and callsign to activate a volume.

Alerting is not working.

For alerts to work, you need to:

1. Create a UAS operation.
2. Activate your UAS operation.
3. Turn alerting on

Blue range rings are created when you create an operation volume. These are just distance markers. If you want the rings to alert, you need to turn alerting on. Go into the "Settings" panel and turn the "ADS-B alerting" on (slide button to show blue).

ADS-B tracks are not moving.

- If you have just powered on the UASP-kit and the browser window/tab with the UASP-kit webapp is already open, the ADS-B tracks you are seeing might be from the previous session. Refreshing the page will update the ADS-B data.
-

I cannot access or I am having trouble connecting to the UASP-kit webapp on the iPad.

Cable is unplugged.

- Check both ends: all components in the UASP-kit are plugged into the power strip.
- Check both ends: the ADS-B receiver is connected to the PoE via ethernet cable.
- Check both ends: the PoE is connected to the LTE router via ethernet cable.
- Check both ends: the LTE router is connected to the Mac Mini via ethernet cable.
- Check both ends: the iPad is connected to the Mac Mini via USB-C cable.
- Refresh the UASP-kit webapp.

If you are successful, the UASP-kit webapp will load and you will hear a “BEEP” sound.

If you are still unable to access the UASP-kit webapp,

- power off the UASP-kit and power it back on.
- Wait 5 minutes.
- Refresh the UASP-kit webapp.

If you are successful, the UASP-kit webapp will load and you will hear a “BEEP” sound.

If you are still unable to access the UASP-kit webapp, call Lauren (408-515-3924) or Lynne (650-224-9587)

I got an error when trying to save the map file I just loaded.

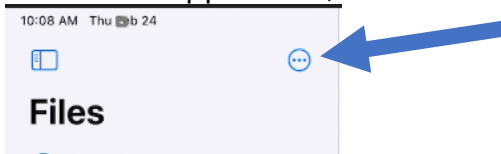
- Map filenames cannot contain special characters. For example, you cannot have the forward slash character “/” in the name. Try a filename without this or other special characters.

I don't see the uaspkrit folder listed in the Files application.

Or

How do I reconnect to the uaspkrit folder in the Files application?

- In the Files application, click the more options button in the left side-bar:



- Select “Connect to Server”.
- In the server field, type in:
`smb://192.168.0.11`
- Then select “Connect”.

Frequently Asked Questions (FAQ)

Why is the date incorrect in the status bar (black bar with orange writing at the top of the screen)?

The UASP-kit determines the date from GPS satellites. The date will be incorrect until the UASP-kit has been powered-on and locks onto sufficient satellites to download the date.

What altitude reference is used for the ADS-B tracks?

The UASP-kit reports ADS-B tracks in feet above Mean Sea Level (MSL).

Why should I set up an operational volume?

The ADS-B alerting, and filters are tied to (the location of) your operational volume. If you would like to switch on alerting, you need to set up an operational volume.

Why did the UASP-kit not immediately move to the incident map I just downloaded?

To move to a recently loaded map, you must go to the map icon, then select “Activate” next to “last uploaded map.” Your UASP-kit should re-center over your newly uploaded and activated map.

Why does the UASP-kit start up in a different location than where I left it?

When you open a browser window/tab to the UASP-kit webapp, the UASP-kit will remember where you have the map centered for that session (for that one open window/tab). If you open a new window/tab, or close and re-open your existing one, the UASP-kit will no longer have the map centered stored and will move to a default location (usually the location of your last uploaded map).

Why are some aircraft altitudes negative?

The reason some aircraft are shown with a negative altitude is because they are reporting negative altitudes. This is possibly because the pilot has not entered the correct local barometric pressure setting into their altimeter.

Why do I hear four beeps when attempting to load a new incident map on the UASP-kit?

The four beeps means that the UASP-kit was unable to convert the GeoPDF. This is possibly because the format of the GeoPDF is incompatible with the UASP-kit.

Why aren't the ADS-B tracks moving?

If you have just powered on the UASP-kit and the browser window/tab with the UASP-kit webapp is already open, the ADS-B tracks you are seeing might be from the previous session. Refreshing the page will update the ADS-B data.

Why don't I see my location on the map?

If you don't see your location (indicated by a blue dot) on the map, it is because the UASP-kit has not locked onto enough satellites to determine your position.

Where are the alert distances measured from?

The caution (yellow) and warning (red) alert distances are measured from the center point of your operation (point radius).

Can I have one altitude for my caution (yellow) alert and a different altitude for my warning (red) alert?

Not at this time. Both alerts use the same altitude.

Will I receive alerts for aircraft I have filtered out?

No. Aircraft that are filtered out will not trigger alerts. Be sure that your filter values do not conflict

with your alert values.

Can I mute alerts, and for how long?

Yes, you can mute alerts. The mute button will mute the current set of audible alerts until a new ADS-B track triggers a new alert or an ADS-B track triggers a higher priority alert (ADS-B triggering a caution alert crosses into the warning area and triggers a warning alert).

Why do I need to wait five minutes before using the UASP-kit upon powering it on?

Waiting five minutes gives the router enough time to boot up and re-establish the local network needed to connect all the UASP-kit components. For more information, please refer to the UASP-kit components & functions section.

Why did I not get an alert when an aircraft flew into my operational volume on the display?

Check that the aircraft is not on your whitelist. Check that the aircraft alert is not muted.

Notes on temperature

While some components of the UASP-kit have a wide range of temperatures in which they will operate, in the specifications sheets, the most sensitive components (mac mini) are only said to work in the 50°F to 95°F range.

Cold weather: Testing has shown that the mac mini will operate in temperatures a little below freezing for two hours and that the iPad is the component most sensitive to the cold.

Hot weather: Testing is incomplete but limited testing has shown that all components will operate in ambient temperatures of 90°F for two hours.

Min and max operations temperatures from manufacturer specifications sheets

Component	Number of image in Fig. 1	Minimum operating temperature	Maximum operating temperature
Computer (mac mini)	2	50°F	95°F
iPad	8	32°F	95°F
PoE	5	32°F	104°F
Battery (yeti)	1	32°F	104°F
LTE router – 2 types	4	32°F or -22°F	122°F or 158°F
Ping station – 2 types	3	-40°F	149°F or 176°F

Notes on humidity.

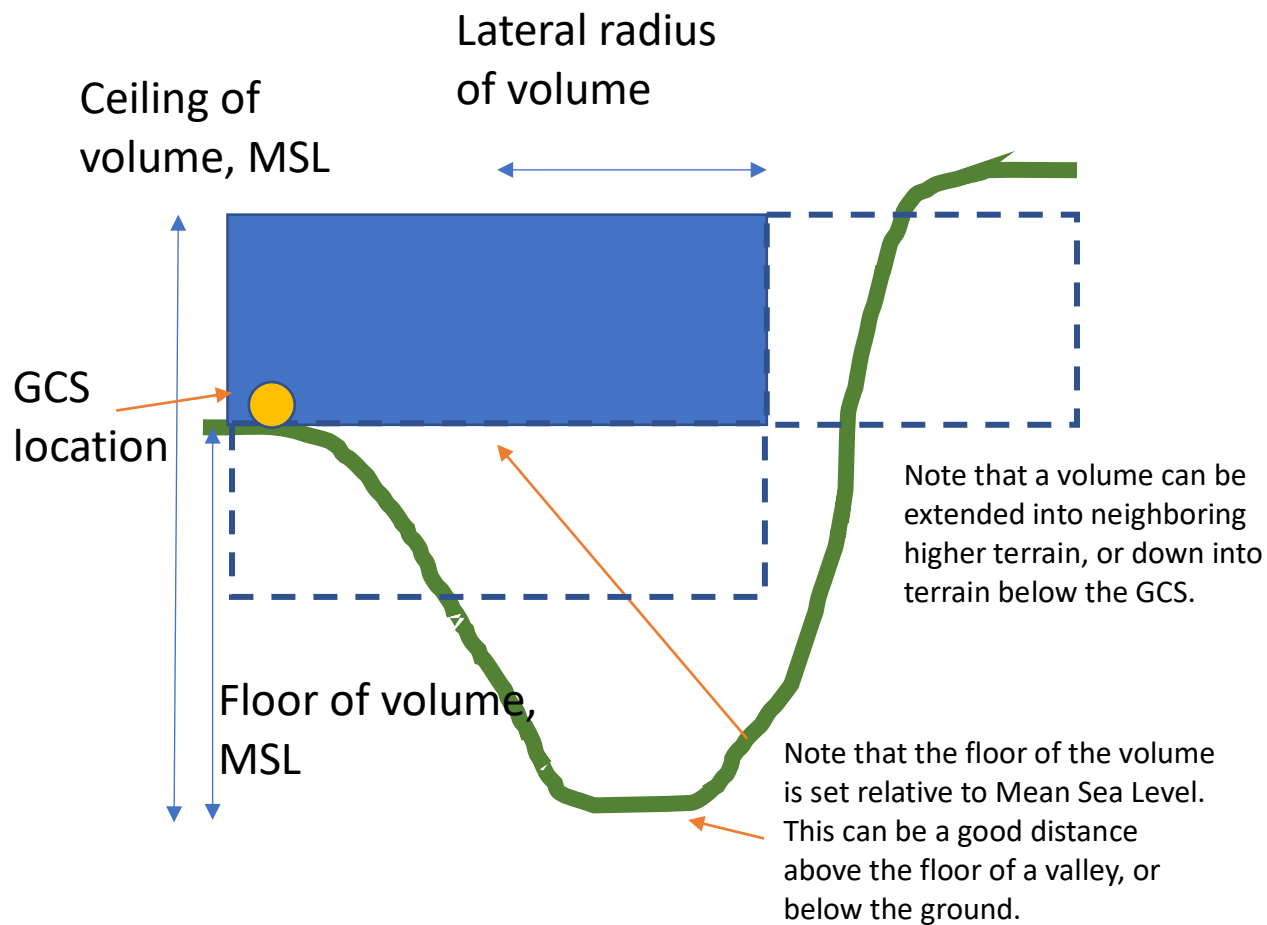
The user should avoid getting the UASP-kit wet – keep the UASP-kit out of the rain – it has not been water sealed. The UASP-kit has only been tested at humidity between 50% and 90%, all components continued to work under all tests. Beyond this, the manufacturers note all components of the UASP-kit are tolerant to a large range in humidity – 20% to 95%.

Min and max tolerance for humidity from manufacturer specifications sheets

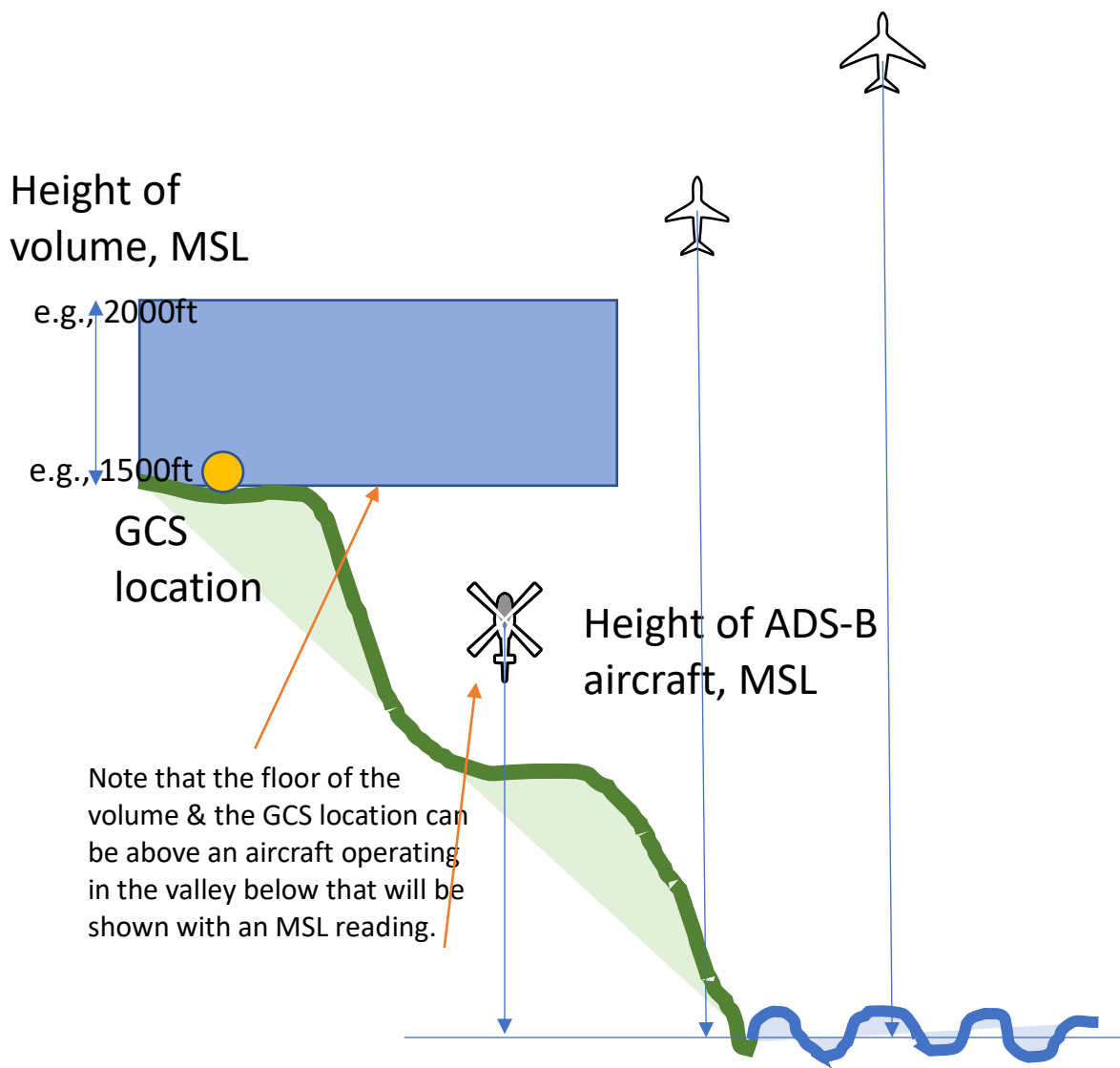
Component	Number of image in Fig. 1	Minimum operating humidity	Maximum operating humidity
Computer (mac mini)	2	5%	95%
iPad	8	5%	95%
PoE – 2 types	5	10%-20%	95%
Battery (yeti)	1		
LTE router – 2 types	4	5%	95%
Ping station – 2 types	3	-	-

Additional notes

Volume properties



The altitude of ADS-B traffic is given in feet MSL (mean sea level).



UASP-kit Components & Functions

Portable power station (Goal Zero Yeti 500x)

Supplies power to UASP-kit components via the built-in 120V AC inverter port

How long can the yeti 500x run the UASP-kit?

Approximately 6 to 8 hours on a full charge

How much power does the UASP-kit need?

On average, between 35-44 watts.

Power strip (6-outlet surge protector)

6-outlet surge protector delivers power from the power source to the PoE, router, and computer

Why does the UASP-kit need a power strip?

It is important that all hardware components are powered on at the same time. Since we are using off-the-shelf hardware that is consumer grade and the portable power supply we provide only has two AC ports, using a power strip was a simple but effective solution.

ADS-B receiver (uAvionix pingStation V1 or V3)

Provides ground surface or low altitude ADS-B surveillance on the 1090 MHz and 978 MHz frequency bands. Detects and receives data from ADS-B equipped aircraft within line of sight of the antenna.

Why does the UASP-kit use this pingStation? What about other ADS-B receivers?

The uAvionix pingStation (all versions) decodes and converts raw ADS-B data as User Datagram Protocol (UDP) packets in JavaScript Object Notation (JSON) format and can be configured to forward the ADS-B data to a Javascript server application (UASP-kit software) on the computer. All of this happens over a single Ethernet connection to the same LAN as the computer. This was one less step we had to do ourselves, which let us get to work on other aspects of the UASP-kit development.

The level of effort involved in supporting other ADS-B receivers depends on the connection type and the format of the data.

Power over Ethernet (PoE) injector (TP-Link)

Delivers both power and data communications to the ADS-B receiver.

Why does the UASP-kit need a PoE?

It's not so much the UASP-kit that needs it, but the ADS-B receiver. Rather than a traditional power cable, the ADS-B receiver gets power over an ethernet cable in addition to sending and receiving data. The specific LTE router (IBR900) is not capable of providing power to the ADS-B receiver, therefore a dedicated PoE injector is needed.

Why does the UASP-kit use this PoE?

It meets the power requirements of the ADS-B receiver. Alternate PoE injectors can (and have) been used, so long as they meet the requirements set forth by the ADS-B receiver manufacturer. Other PoEs used:

Rosewill RNWA-PoE-4065 4-Port Gigabit PoE

AMX- FG423-83 PoE Injector

LTE Router (Cradlepoint IBR 900)

Creates a LAN to enable communication between the ADS-B receiver and the computer. Pre-installed FirstNet SIM card enables the UASP-kit software to connect to the internet and download map tiles.

What is a LAN? Why does the UASP-kit need one?

LAN stands for Local Area Network. The UASP-kit display is a web browser application that is only accessible by devices on the same network as the host computer. The ADS-B receiver is also configured to send data to a specific address on the LAN (i.e., the computer). By design, the LTE router does not host a WIFI network and the only way for the UASP-kit hardware to be in the same LAN is through physical ethernet connections. The once exception is the tablet, which gets its network connection from a “share network connection” option on the computer through the USB-C cable. The LTE router, ADS-B receiver, computer, and tablet have all been preconfigured to automatically join the LAN.

What happens if there is no LTE connection?

The UASP-kit software uses an internet connection to fetch map tiles (e.g., satellite view on the map). Without an LTE connection, the UASP-kit will be unable to connect to the internet and fetch new map tiles. This does not change the functionality, only the aesthetics of the map. All the underlying map data is still there, and you will still be able to use the UASP-kit. In situations where you don't have map tiles, you can still load a geoPDF as an overlay on the map.

Can we cache map tiles when we do have an internet connection?

We have not added any software to cache map tiles, but we have experienced some amount of map tile caching done by the platform.

Computer (Mac Mini) & Tablet (iPad)

Computer: Hosts the Javascript server application that processes ADS-B data, hosts the application and its resources (sounds, icons, and map tiles) via an Apache Web Server, and a REST web service that will automatically convert and store GeoPDF incident maps.

Tablet: Serves as the UASP-kit user interface

Where is the monitor?

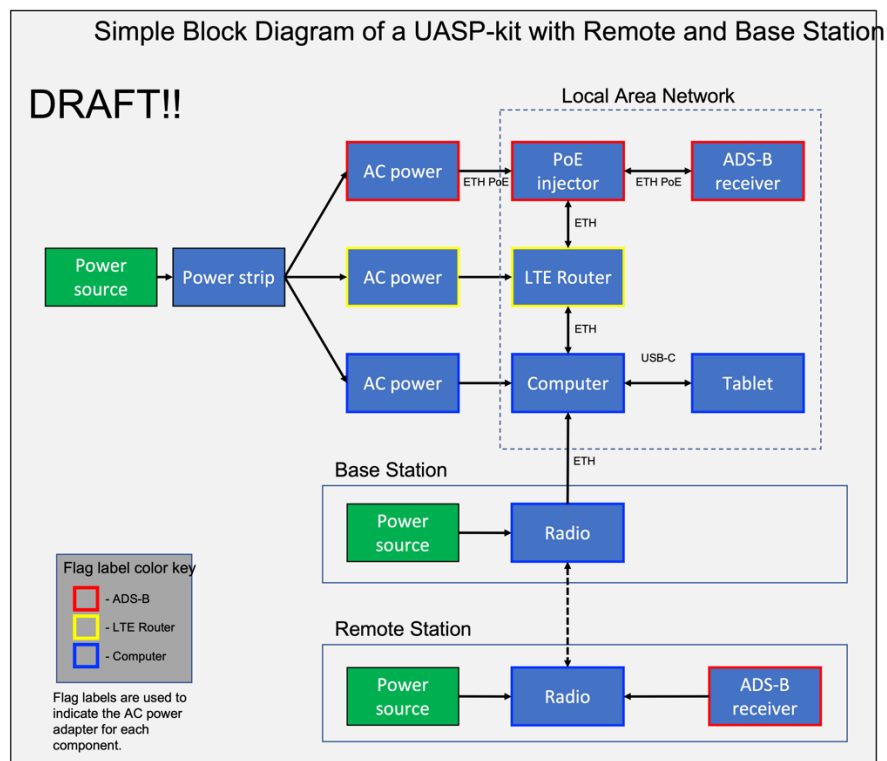
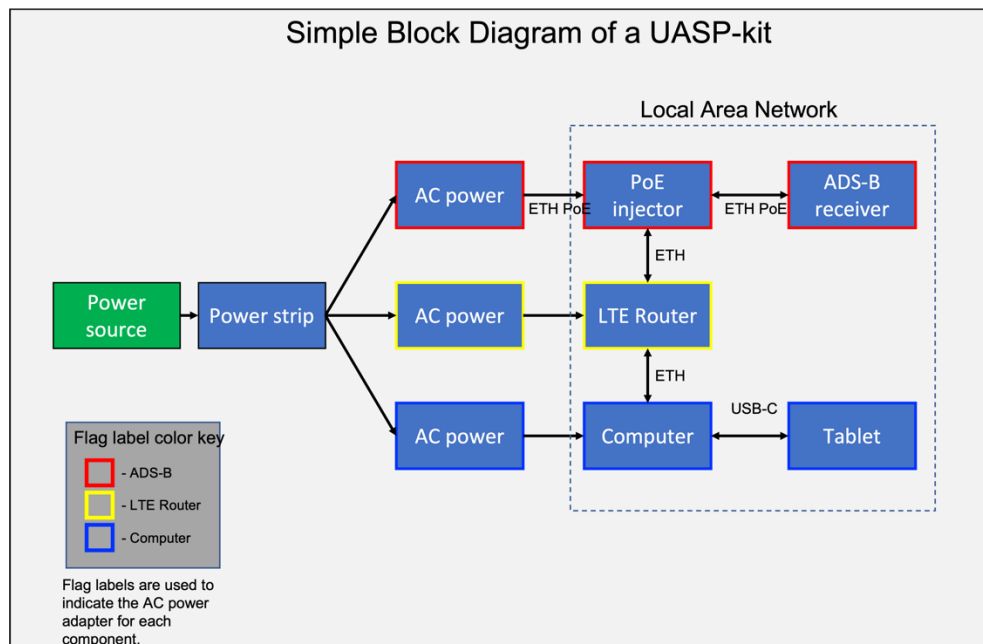
The UASP-kit uses a “headless” Mac Mini – meaning everything is set up to run without the need for a monitor (or mouse and keyboard) during nominal use. A monitor, mouse and keyboard are only needed if something needs to be adjusted on the Mac Mini itself, such as when a researcher needs to update the UASP-kit software.

Why is it important that the tablet be connected to the computer?

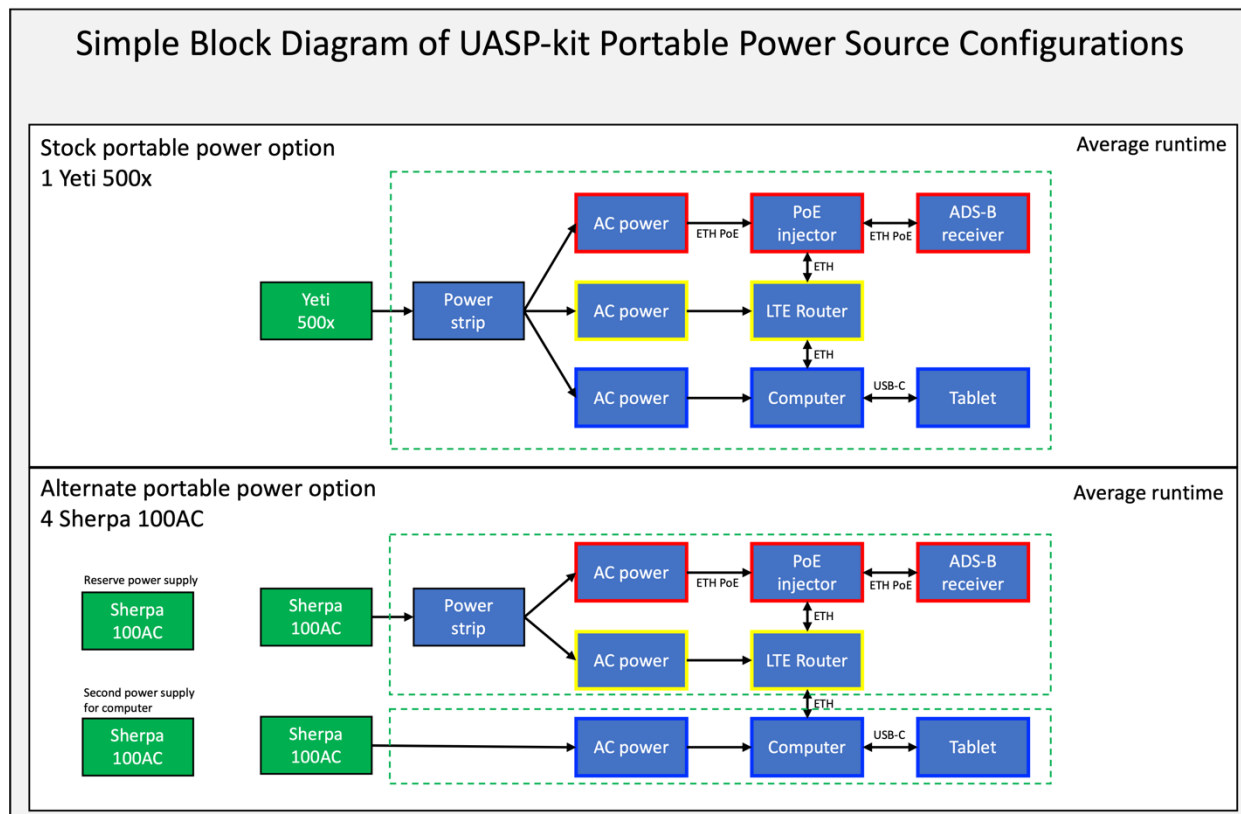
The Mac Mini has been configured to share its network connection with the iPad through the USB port. The iPad needs to be on the same LAN as the host computer in order to access the UASP-kit web application. Since the only way to be on the UASP-kit LAN is through physical connections, we leveraged the option to share a network connection from the Mac Mini to the iPad. This approach also keeps the iPad connected to a power source as it can receive power from the Mac Mini.

Prototype Hardware Configuration

Simple block diagram – single and remote



Simple block diagram – power options



Recording UASP-kit issues for reporting to AOL

Taking screenshots

If you experience an issue with the UASP-kit, we would like to know. It would help if you could take a screenshot of the event to include when you report the kit's errors.

To take a screenshot, click the "off" button and the "raise-volume" button at the same time. the iPad will take a shot and show it briefly as a picture-in-picture. The image will be stored in the



photos application

See <https://support.apple.com/en-us/HT210781> for more details.

Taking video

If you experience an issue with the UASP-kit that develops or progresses, it would help if you could take a short video of the event to include when you report the kit's error.

To take a video, swipe down in the top right corner of the iPad. This will bring up a settings panel. Click the lower left icon  to start recording. The iPad will

countdown to begin recording and the icon on this settings panel will turn red.



To stop the recording, press the "recording" icon  on the top right of the screen, and choose "stop" on the pop-up panel. The iPad will show the last frame briefly as a picture-in-picture.



The video will be stored in the photos application

See <https://support.apple.com/en-us/HT207935> for more details.

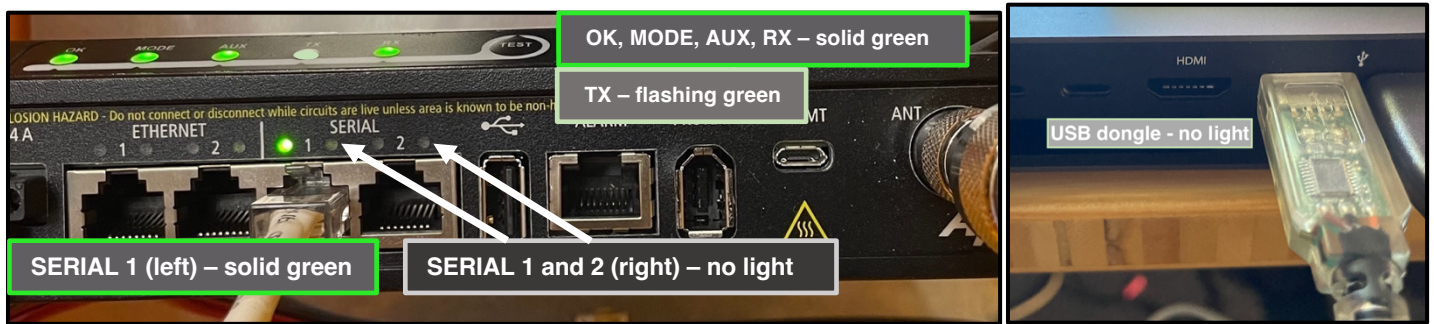
User Guide Info.

If you would like to refer to the pdf of the user manual while you have the UASP-kit running, open the user manual so that the pdf symbol shows on the lower menu bar.

Then open the UASP-kit and drag the pdf from the lower menu bar up to the right side of the screen. The iPad should split the screen between the two applications.

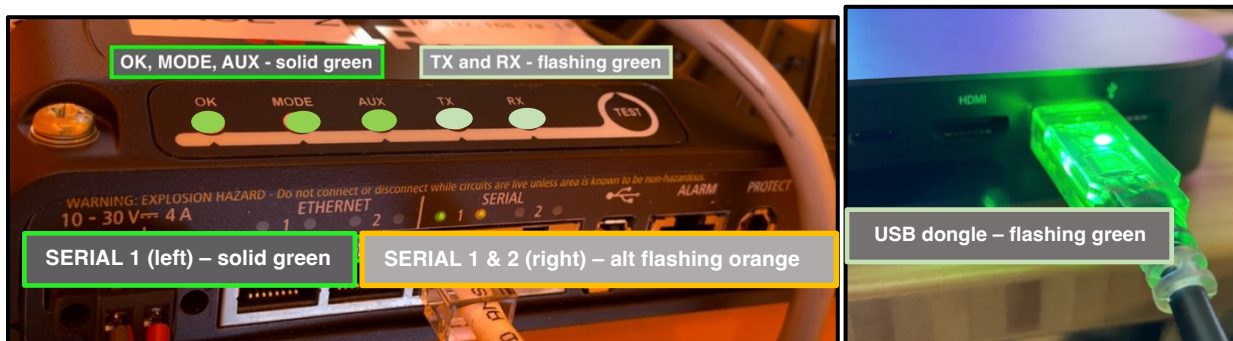
Understanding base station 4RF radio LED lights

Base station 4RF radio is on but does not have connection to the remote station.



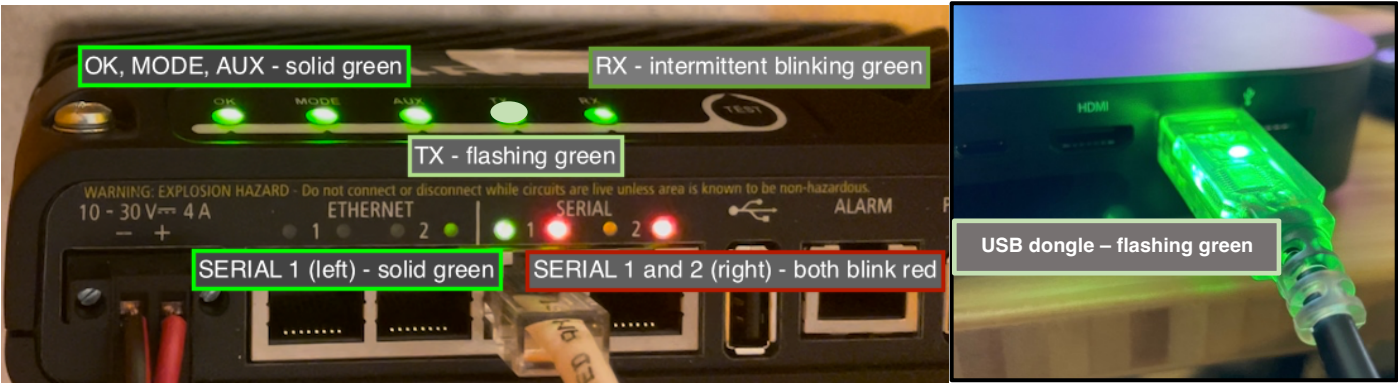
LED	status	indicates
OK	solid green	functions OK
MODE	solid green	processor block is OK
AUX	solid green	USB interface OK
TX	flashing green	RF path TX is active
RX	solid green	Rx path OK (not active)
SERIAL 1 (left)	solid green	RS-232 device is connected
SERIAL 1 and 2 (right)	none	no data is present on the interface

Base station 4RF radio is on, connected to the remote station, and is receiving data.



LED	status	indicates
OK	solid green	functions OK
MODE	solid green	processor block is OK
AUX	solid green	USB interface OK
TX	flashing green	RF path TX is active
RX	flashing green	RF path RX is active
SERIAL 1 (left)	solid green	RS-232 device is connected
SERIAL 1 and 2 (right)	alternate flashing orange	data is present on the interface

Base station 4RF radio is on, has connected to the remote station, but is not consistently receiving data.



LED	status	indicates
OK	solid green	functions OK
MODE	solid green	processor block is OK
AUX	solid green	USB interface OK
TX	flashing green	RF path TX is active
RX	blinking green	RF path RX intermittently active?
SERIAL 1 (left)	solid green	RS-232 device is connected
SERIAL 1 and 2 (right)	blinking red	data is intermittently present?

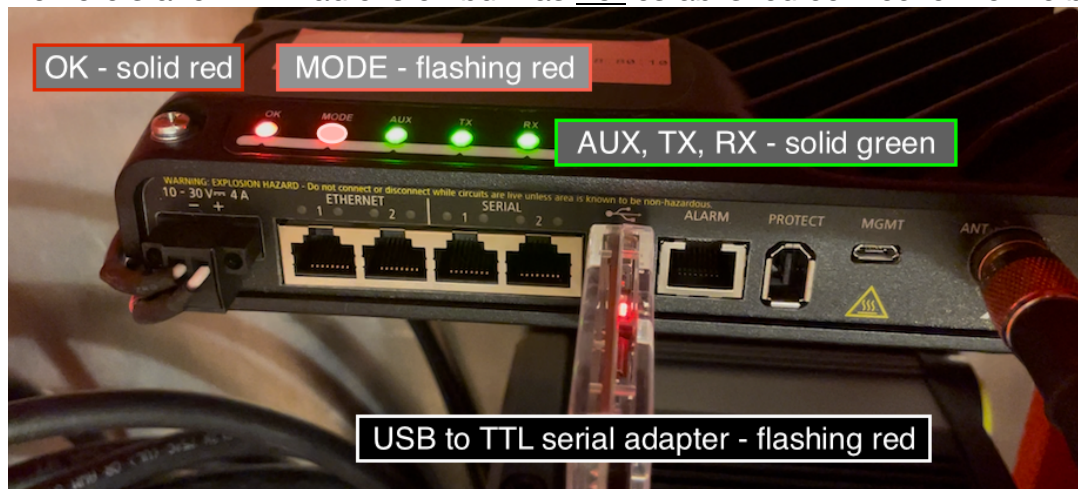
Understanding remote station 4RF radio LED lights

Remote station 4RF radio is on, has connected to the base station, and is transmitting data.



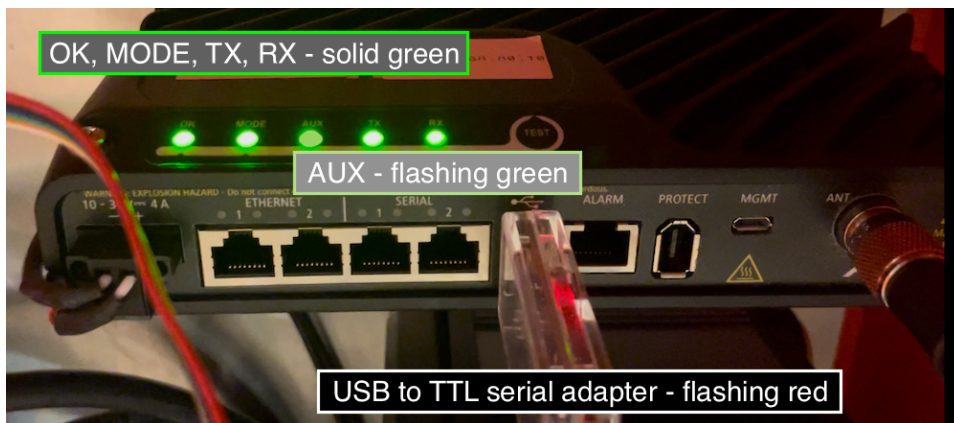
LED	status	indicates
OK	solid green	functions OK
MODE	solid green	processor block is OK
AUX	flashing green	Tx/Rx data on the USB host port
TX	flashing green	RF path TX is active
RX	flashing green	RF path RX is active
USB to TTL serial adapter	flashing red	receiving pingRX Pro data

Remote station 4RF radio is on but has **not** established connection to the base station.



LED	status	indicates
OK	solid red	radio not connected to base station
MODE	flashing red	radio has not registered with the network
AUX	solid green	USB interface OK
TX	solid green	Tx path OK (not active)
RX	solid green	Rx path OK (not active)
USB to TTL serial adapter	flashing red	receiving pingRX Pro data

Remote station 4RF radio is on and is no longer connected to the base station.



LED	status	indicates
OK	solid green	functions OK
MODE	solid green	processor block is OK
AUX	flashing green	Tx/Rx data on the USB host port
TX	solid green	Tx path OK (not active)
RX	solid green	Rx path OK (not active)
USB to TTL serial adapter	flashing red	receiving pingRX Pro data

Glossary

Terms used in the UASP-kit Manual

ADS-B alerting (panel)

Refers to two different types of alerts: caution (yellow, outer ring) and warning (red, inner ring). Toggle **ON** to trigger banners and tones, for both alert types, when ADS-B traffic files inside of the alert rings surrounding your operation.

ADS-B filter

A tool that allows you to filter your view of ADS-B tracks by range and altitude.

ADS-B track

Refers to the aircraft icon and green “breadcrumb” trail.

Alert banners (ADS-B alerting)

Refers to the grey box that appears in the black area at the top of the screen containing a caution or a warning when an ADS-B aircraft crosses one of the alerting rings on the display. The box contains known information about the aircraft and its distance from the center of the operation.

Alert rings (ADS-B alerting)

Refers to the adjustable yellow (caution) and red (warning) rings that surround your active operation. The system will notify you when ADS-B aircraft cross either of the rings.

Audio alerts (ADS-B alerting)

A chime and a “horn” tone that sound as an ADS-B alert is identified.

Breadcrumbs

The green circles that form a trail (or history) behind each aircraft track.

Caution alert (ADS-B alerting)

The yellow outer alerting ring that is further away from your operation, associated with a chime tone.

Caution banner

Refers to the grey box that appears at the top of the screen containing a caution when an ADS-B aircraft crosses the outer alerting ring on the display. See ‘alert banners’ above.

Data tag

Refers to the box next to the ADS-B track icon, currently showing the callsign, altitude, speed and climbing or descending.

GPS status

When the GPS data is acquired, the header bar will show the level of position accuracy available to the UASP-kit– from 0 satellites up to DGPS (Differential Global Positioning System/Service), which is 4 or more satellites.

Handles

Small white boxes at the corners and center of a cube volume (or on the border at the top right and in the center of a “hockey puck” volume) that can be used to drag the volume to a different size (by placing your fingertip on the square and dragging).

Map style options

To be found under the icon in the top right of the screen that is 3 lines (also known as a “hamburger menu”). Opening this panel will allow you to select different types of base map and toggle the incident map on/ off.



Map button (side menu)

Located on the left of the map, this button opens the “Select active incident map” panel.

Map tiles

Square segments of the base map that are put together (tiled) to form the map view across the whole display.



Operation button

Located on the left of the map, this button opens the “Operation set up” and “Operation details” actions panels.

Operation details (panel)

First of two panels through which you can set up and activate an operational volume.

Operation setup (panel)

Second of two panels through which you can set up and activate an operational volume.

Operation volume

A 3-dimensional area of space, defined by the user, in which they intend to fly their UAS operation. An alert can be set for the boundary of this volume through the Settings panel.



Settings button

Located on the left of the map, this button opens the “Settings” actions panel through which you can set filters and alerting.

UASP-kit status bar

The black banner across the top of the screen. The orange text in the first row tells you the date and time if the GPS has a lock, how many GPS satellites are in view, the status of the system and whether the alerts are on. Alert details will show in the second two rows of the banner.

Warning alert (ADS-B alerting)

The red inner alerting ring that is closer to your operation, associated with a “horn” tone.

Warning banner

Refers to the grey box that appears at the top of the screen in the black status bar containing a warning when an ADS-B aircraft crosses the inner alerting ring on the display. See ‘alert banners’ above.

Zoom (button)

Tool that allows you to move into the map to see a smaller area in more detail (zoom in) or back out of the map to see a larger area in less detail (zoom out). You can also zoom in/out by pinching the screen.

Acronyms and Abbreviations

AC – alternating current

ADS-B - Automatic Dependent Surveillance-Broadcast

AGL - Above Ground Level

DGPS – Differential Global Positioning System/Service

ft - feet

GCS - Ground Control Station

GPS – Global Positioning System

hr – hour

JSON – JavaScript Object Notation

LAN – local area network

lat - latitude

lbs - pounds

LED - Light Emitting Diode

long – longitude

LTE – Long Term Evolution

MSL - Mean Sea Level

nmi - nautical miles

PoE - Power over Ethernet

REST – RESTful Application Programming Interface

UAS - Uncrewed Aerial System; Uncrewed Aircraft System

UAV - Unmanned Aerial Vehicle

UASP-kit - Uncrewed Aircraft System Pilot kit

UDP - User Datagram Protocol