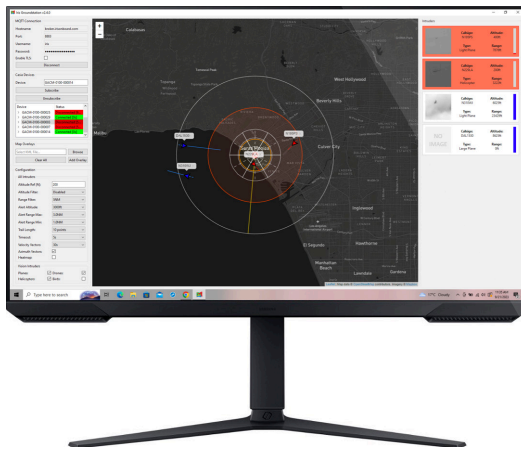
QUICKSTART

Software Version 2.5.0

CASIA® GROUNDSTATION



Ensuring no two aircraft collide mid-air.

uAvionix reserves the right to alter this document at any time without notice.

REVISION 1.2 | 2024-10-30

What's New?

Version 2.5.0 of the Groundstation is compatible with Casia version 3.5

With the most updated version of the software, we have added the capability to save a list of devices; save your configuration setting, especially around filters; and the Casia G Ground Station now has Night Mode. Additionally, the Ground Station has the ability to triangulate if you have more than one system connected.

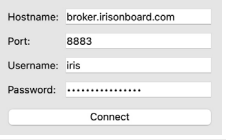
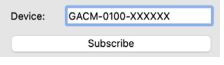
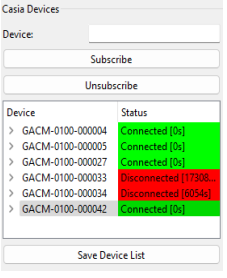
Get Started

The Casia G Groundstation displays the data from your Casia G systems to provide situational awaress to potential air risk to your UAS operaitons. It displays the status of the Casia G devices being monitored, displays detected and observed intruder aircraft, and visualizes the details of those detections on a top-down map. The application also provides features and tools to enhance usability within an operational environment such as filters, map overlays, audible alerts, and more. Details on the features of the application and how to use them can be found in this document.

Download Groundstation

Linux and Mac	Download from here and follow the steps in the README file
Windows	Download here and click to invoke the Windows installer. Click the desktop icon to start.

Connect to Casia G Devices

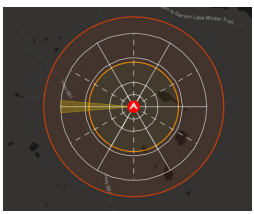
1	Enter the MQTT broker credentials and click Connect. These are defaulted to uAvionix's credentials.	
2	Enter the serial number of your device and click Subscribe. Repeat this step for multiple devices.	
3	View the status of devices (connected or disconnected, with time since last seen in brackets). With the newest software updates, you can connect and save multiple devices.	

Groundstation Basics

Casia G Location on the Map

	Red circles with white arrows indicate the location of each ONLINE Casia G device. The arrow points in the direction of the configured heading of the device.
	Grey circles with white arrows indicate the location of each OFFLINE Casia G device. The arrow points in the direction of the configured heading of the device.
	Red circles with black arrows indicate the location of each ONLINE Casia G device in NIGHT MODE. The arrow points in the direction of the configured heading of the device.

Casia G Field of View Representation

	The white concentric circles around the red arrow icon represent the field of view of the Casia G system, and help you understand the range of each airborne object it detects. The circles are displayed at 0.5km (0.27NM), 1km (0.54NM), 2km (1.08NM) and 3km (1.62NM).

Traffic Detection Legend

Detected air traffic will be represented on the Groundstation map using one of the following icons.

	ADS-B detected air traffic outside of the alerting range. Arrow points in the direction of travel.
	Visually detected airborne objects outside of the configured alerting range.
	The red color indicates the intruder is generating an alert and has breached the configured alert volume.
	Air traffic detected visually AND by ADS-B outside of the configured alerting range. Arrow points in the direction of travel.
	Air traffic detected visually AND by ADS-B, inside the configured alerting state. Arrow points in the direction of travel.
	Location of intruder aircraft that has been identified via triangulation in night mode.

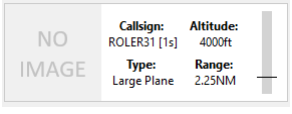
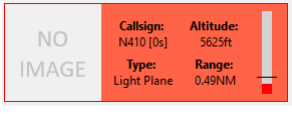
Intruder Detail

When an intruder aircraft is detected a Casia G device, the Groundstation will display details of that intruder both on the map (see icons above) and in the **Intruders** section on the right (see details below).

For each intruder, the following attributes are displayed:

- Image (when detected visually)
- Callsign ('VISION' displayed when only detected visually)
- Type (light plane, helicopter, etc.)
- Range (this value is the distance closest to the Casia G device)
- Altitude (AMSL)
- Altitude indicator bar is color coded. It provides a reference for the intruder altitude above the "Alert Altitude" input setting. The altitude bar is shown in red when the intruder is chose to the alert altitude, and in blue when it is well above the alert altitude.

Intruder Alert Status

	Example ADS-B intruder in the non-alerting state.
	Example ADS-B intruder in the alerting state.
	Example of a purely vision intruder in the non-alerting state.

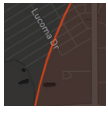
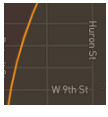
Double-clicking on an intruder widget will zoom and center the map on that intruder, which is a quick and easy way to isolate one intruder's position amongst many intruders.

Display & Alert Configuration

Casia G detects many things in the airspace. The Groundstation has tools to filter out objects that are not of interest, and get alerted (visually and audibly) only to things that are potential risks to your UAS operation.

All Detected Intruders

The following configuration options apply to ADS-B and Visual detections:

Purpose	Purpose
Altitude Ref [ft]	The intruder widget altitude indicator will now change color to red when the altitude is below threshold, and will remain blue when above threshold. It will now auto-scale and use the altitude reference value as its minimum and the altitude reference value plus the altitude filter value as its maximum. It will use a maximum value of 1500 ft above the altitude reference when the altitude filter is disabled.
Altitude Filter	**Alerts / display of high altitude aircraft?** Aircraft can be detected at very high altitudes both visually and by ADS-B receivers. Filtering out traffic far above your operation will reduce the numbers of alerts and the visual clutter of traffic displayed on the screen. Note that the altitude error of visual detections can be up to +/- 700 feet. This should be accounted for when setting the altitude limit.
Range Filter	**Too many aircraft displayed on screen?** Casia G's inbuilt ADS-B receiver can detect cooperative aircraft as much as 100NM away. The Range Limit filter limits that range to reduce visual clutter. The white circle (if present) indicates the boundary inside which ADS-B detected traffic will be displayed. Also has an option for 10 nautical miles, default remains 5 nautical miles--Incrased range is useful at night as the detection range of Casia becomes much greater.
Alert Altitude	The Altitude indicator is now shown in the intruder widget with a black horizontal bar across the vertical altitude indicator.
Alert Range Max 	**Too many alerts of distant aircraft?** Continual audible and visual alerts for everything that is detected but irrelevant to the operation causes distraction and disrupts the UAS operation. To stop alerting to things that you deem are not a risk (e.g. airliner 6 miles away), set the Alert Range Max appropriately. Around 2.0NM is usually good, but will vary depending on your operation. The RED outer circle (if present) indicates the boundary inside which audible and visual alerts will be triggered for detected traffic.
Alert Range Min 	**Too many alerts of birds nearby the Casia?** Continual audible and visual alerts for everything that is detected nearby Casia causes distraction and disrupts the UAS operation. To stop alerting to things that you deem are not a risk (e.g. birds close by, misclassified aircraft), set the Alert Range Min appropriately. Around 1.0NM is usually good, but will vary depending on your operation. The ORANGE inner circle (if present) indicates the boundary beyond which audible and visual alerts will be triggered for detected traffic, within the inner circle visual traffic will NOT be alerted. Note that ADS-B traffic will alert within the inner circle.
Trail length	Traffic that breaches the configured alert region will be highlighted in YELLOW and accompanied by an audible "traffic" alert. It measures in units of seconds.
Timeout	This is the amount of time a detection will persist after it was last detected. A shorter timeout will clear aircraft from the display sooner, but if set too short may cause objects to appear and disappear frequently as there can often be times when signals from aircraft are temporarily blocked by buildings or environmental features.

Visually Detected Intruders

Casia reports on several types of visually detected objects which can be filtered from the display if your operation requires it. Selecting from the list of available object types will display those objects within the Groundstation, de-selecting the object type will hide those objects from the display.

Note that occasionally objects are misclassified as one another (e.g. sometimes soaring birds look very much like planes) so this filter may not be 100% effective if any misclassifications occur.

Persistent Detections on Ground Objects

Due to the way Casia detects objects, it is possible that occasionally ground objects can falsely trigger the detection system and show up in the Groundstation. If an object on the ground such as a cell tower, electricity pylon, tree, etc is being detected by Casia, tools are available in FlightDeck to mask off regions of the image to prevent these false detections.

We recommend in the Casia installation that the entire ground be masked off preemptively during the deployment so as to avoid this from occurring.

Advanced Groundstation Options

Configuration File

More advanced options are listed in the table below and can be enabled via a configuration file, which can be found here:

Documents/ Groundstation/config.ini

Home Lattitude	Sets the position latitude the map will default to when the application is first opened.
Home Longitude	Sets the position longitude the map will default to when the application is first opened.
Map Style	Sets the background map style. Dark is the default as this gives the best contrast with the overlays and icons. Other options are “light” for a white background, and “satellite” for satellite imagery.
Zoom Levels	There are various settings for zoom levels for different purposes. These set the limits or levels for certain actions and alert the feel of the map display.
Sectional Charts	Enables and disables a sectional chart overlay on the map. Set to “True” to enable, “False” to disable.
Weather Radar	Enables and disables NOAA weather RADAR overlay on the map. Set to “True” to enable, “False” to disable.
Solar terminator	Enables and disables day/night solar terminator overlay on the map. Set to “True” to enable, “False” to disable. Note this can cause some visual anomalies and is best left disabled unless day/night view is necessary.
Sun FoV	Enables and disables display of a “wedge” on the map where the sun is within the field of view of each Casia system. Set to “True” to enable, “False” to disable.
Device Timeout	Sets the timeout in seconds for devices to be detected as offline once messages stop being received from them. Default is 5 seconds.
Log Directory	Sets the directory in which to log data generated by the Casia Groundstation.
Log Raw Messages	Enables and disables logging of raw messages received from Casia systems. Can be useful for debugging.
Overlay Directory	Sets the folder where KML file overlays are loaded from..
Auto Overlay Enabled	Enables and disables the automatic loading of KML file overlays from the above folder.
Intruder Altitude Reference Default	Sets the default altitude reference value in meters.
Intruder Altitude Reference Default	Sets the default altitude reference value in meters.
Intruder Type Filter Strength	Sets how strict the Groundstation will be with the intruder type filter.

Show Vision Intruder Vectors	Enables and disables the display of intruder velocity vectors for vision only intruders. Disabled by default as the heading and velocity estimates are rough.
Show Vision Intruder Trails	Enables and disables the display of intruder history trails for vision only intruders. Disabled by default as they can jump around a lot.
MQTT Hostname	Sets the default MQTT hostname that will be populated within the interface when the application is loaded.
MQTT Port	Sets the default MQTT port that will be populated within the interface when the application is loaded.
MQTT Username	Sets the default MQTT username that will be populated within the interface when the application is loaded.
MQTT Password	Sets the default MQTT password that will be populated within the interface when the application is loaded.
TLS Enabled	Sets the default MQTT TLS setting that will be populated within the interface when the application is loaded.

Map Overlays - KML Files

KML files map be uploaded in the **Map Overlays** section of the Groundstation (left panel), This can be useful, for example, to represent an area of operation. These will be displayed in blue as shown to the left.

Limitations and Disclaimers

Filters must be selected carefully by the operator. Agressive filtering may result in audible and visual alerts not being presented to draw the operators attention to intruding aircraft, potentially increasing risk to the operation.

Setup and maintenance of Casia G must be performed as per the Casia user guide to ensure that Casia performs optimally. Contact support@uavionix.com for assistance.

Incorrect installation can affect Casia performance:

- If the field of view of the camera is partially obscured - for example - by a building, pole, tree, or any other object including bugs and water droplets, Casia will not detect as specified.

uAvionix leverages artificial intelligence and machine learning to ensure Casia 'learns' to correctly interpret its environment. Casia has been trained to identify small piloted aircraft and helicopters, and is designed for use in low risk airspace, some distance away from airports. The performance and limitations of the Casia system should be understood by the pilot in command before using Casia G as part of a layered air risk mitigation approach.

- If Casia has not been 'trained' in an environment similar to yours, performance - including the frequency of false positives - may vary from that specified.
- Casia has been optimized for low risk airspace, away from airports. If Casia 'sees' larger aircraft (e.g. Boeing 747) several miles away, it may report a smaller aircraft at a closer range.
- Casia was not trained to detect powered parachutes, balloons, large planes/jets, other aircraft or other objects. This should be considered by the operator when evaluating air risk.
- Casia may not detect every aircraft in all environments under all circumstances, and may not detect all intruders early enough for an avoidance maneuver to be successfully performed. This must be considered during air risk assessment.
- The time taken for Casia to detect uncooperative piloted aircraft can vary due to environmental conditions, distance, aircraft size, clutter, smoke, and other factors.
- Depending on the performance (turn radius, cruising speed, ascent/descent rates, acceleration/deceleration rate) of your UAS, the time taken to avoid a detected intruder aircraft will vary. This must be considered during air risk assessment.
- Casia G does not detect static objects.

The specified Casia performance was based on actual encounters with piloted aircraft intruding from above the skyline. Performance below the skyline is still being assessed and should therefore be presumed to be significantly lower.

Reliability / average uptime of the Casia System is under evaluation.

Your Casia system should be replaced following a heavy impact, or should be returned to uAvionix for evaluation and repair.

If you believe Casia may not be performing correctly, it should NOT be used and support@uavionix.com should be contacted for guidance.

For regulatory guidance, please contact sales@uavionix.com.

Ensuring no two aircraft collide mid-air.

uAvionix Inc. 300 Pine Needle Lane, Bigfork, MT. 59911 USA.