DATASHEET

CASIA X

Ensuring no two aircraft collide mid-air.

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

REVISION 1.1 | 2024-10-08

CONTENTS

CASIA® X

The world's smallest, lightest, lowest power, 360° coverage Detect, Alert, Avoid (DAA) solution for unpiloted aircraft.

Features

DETECT & AVOID

Sense non-cooperative aircraft using a patented computer vision and AI system.

INTEGRATED ADS-B

Integrated ADS-B for increased coverage with cooperative aircraft.

COLLISION AVOIDANCE

Avoid collisions with automatically executed, safe, drone maneuvers.

PILOT-IN-COMMAND

Report detected intruder aircraft to the ground-station and pilot-in-command in real time*.

LOW SIZE, WEIGHT & POWER

Low SWaP (Size, Weight, and Power) for easy integration on small UAS platforms.

AUTOPILOT COMPATIBLE

Turn-key integration with supported autopilot systems. Supports common commercially available autopilots.

*Requires support from the autopilot and ground-station software being used.
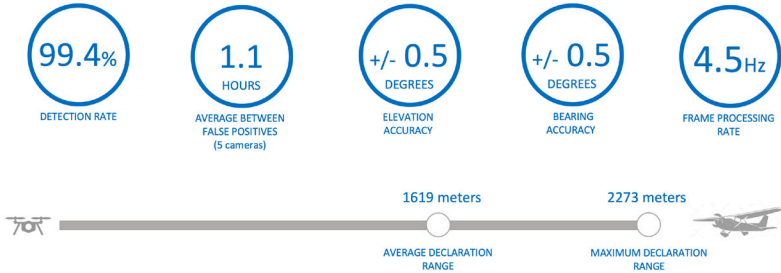
Quality and Compliance

Designed in the USA. Assembled in the USA from domestic and imported components.

Compliant with FCC Part 15 (USA), Industry Canada. Please recycle all electronics.

FC IC ⌧

Performance Specifications

Casia detects and classifies small single engine aircraft, single disk rotorcraft, birds and multirotors.

99.4%	1.1	+/- 0.5	+/- 0.5	4.5Hz
DETECTION RATE	HOURS	DEGREES	DEGREES	
	AVERAGE BETWEEN FALSE POSITIVES (5 cameras)	ELEVATION ACCURACY	BEARING ACCURACY	FRAME PROCESSING RATE

1619 meters   2273 meters

AVERAGE DECLARATION RANGE   MAXIMUM DECLARATION RANGE

SMALL PLANE

Maximum Declaration Range	**2273m**
Average Declaration Range	**1619m**
Range Estimation Accuracy	**+/- 16.2%**
Classification Precision	**100%**
Bearing Accuracy	**+/-0.5 degrees**
Speed Estimation Error	**+/-34.7m/s**
Average Time Between False Positives - 5 cameras	**1.01 hours**
4 cameras	**1.25 hours**
3 cameras	**1.67 hours**

Note: Declaration range is the distance at which Casia detects an intruder aircraft and classifies it, for example, as a small plane, helicopter, bird, or multirotor.

IMPORTANT

Casia X has been trained and tuned to detect and classify small GA aircraft. The above detailed performance is specific to the detection of small GA aircraft (small planes and helicopters). Casia X will not perform to the above level when intruder aircraft are small drones. This is the case even when aircraft scale is considered, as there are many factors involved in etecting crewed aircraft.

The above performance specifications will not be achieved in all environments and conditions. See Limitations and Disclaimers for additional information. See the Casia X User Guide for performance evaluation criteria.

Performance improves as software releases are made and uAvionix reserves the right to alter the above performance data without notice.

Components

MODULE

- ☐ 1x Casia Module

- ☐ 1x RS-232 Serial Cable

- ☐ 2x Power Input Cables

- ☐ 1x Serial UART Cable (Pixhawk Standard)

CAMERA

The components below are provided for each camera:

- ☐ 1x GigE Camera Assemblies (with lens caps)

- ☐ 1x Lens cloth

- ☐ 1x Industrial Ethernet Camera Cables

Autopilot Support

The following table shows the levels of support and testing for different versions of the autopilot firmware that are supported by Casia.

	Collision Avoidance	Intruder Downlink	Alerts	ADS-B Passthrough
ArduCopter	3.4.0+ (descend)	3.4.0+	3.4.0+	3.4.0+
ArduPlane	3.4.0+ (right turn)	3.4.0+	3.4.0+	3.4.0+
PX4	1.9.0+ (right turn)	1.9.0+	1.11.2+	1.9.0+
Piccolo	2.2.4h (left & right turns)	2.2.4h	2.2.4h	2.2.4h
UAV Navigation	Contact support@uavionix.com			

For additional autopilot support, contact sales@uavionix.com

Ground Control Station Compatability

The following features have varying support from the respective ground control station software packages available.

	Intruder Display	Intruder Alert	Avoidance Alert	Health Alert
Mission Planner	Yes	Yes	Yes	Yes
QGround Control	Yes	No	Yes	Yes
Piccolo Command Center	No	Yes	Yes	Yes
Visionair	Contact support@uavionix.com			

Hardware Specification

Number of Cameras	5	4	3
Power	~65W nominal 70W Max	~62.5W nominal 70W Max	~60W nominal 70W Max
Mass (module + Cameras)	~2400g	~2150g	~1900g
Field of Regard	Horizontal: 360 degrees (40 degrees total overlap) Vertical: 50 degrees	Horizontal: 290 degrees (30 degrees total overlap) Vertical: 50 degrees	Horizontal: 220 degrees (20 degrees total overlap) Vertical: 50 degrees

Casia X Module

SPECIFICATION

Input Voltage	**12V-36V DC**
Power	**65W Nominal, 70W Peak**
Mass	**Casia Module: ~885g**
External Dimensions	**Module: 103mm (W) x 168mm (L) x 52mm (D)**
	Camera: 60mm (W) x 60mm (L) x 105mm (D)
*Operating Temperature	**0℃ to 60℃**
Storage Temperature	**-45℃ to 85℃**
*Ambient Humidity	**85℃ / 85% RH, 168 hours**
*Shock	**140G, 2ms**
*Vibration	**10Hz to 200Hz, 1G and 2G RMS**
Proceesing Unit	**nVidia Jetson Xavier AGX**
*Over Water	**Casia may work over water but has been insufficiently tested. Contact support@uavionix.com for advice.**
*Over Sand	**Casia may work over sand but has been insufficiently tested. Contact support@uavionix.com for advice.**
*Over Snow	**Casia may work over snow but has been insufficiently tested. Contact support@uavionix.com for advice.**
Autopilot Interfaces	**TTL Serial UART (x2)**
	RS-232 Serial (x2)
	CAN Bus (x2)
Cameras Interfaces	**802.3at PoE Industrial Ethernet (x6)**
	30W max power delivery across all 6 ports

* Indicates that testing is ongoing and that these are expected values.

ELECTRICAL

The following specifications are on a per-module basis. Pictures are for reference only and may not reflect exact connector.

POWER INPUT

EXTERNAL MARKINGS: 12-36V
CONNECTOR SERIES: Molex Micro-Fit 3.0
MATING CONNECTOR: 43025-0400
(housing), 245132-0410 (cable assembly)
CRIMP TERMINALS: 43030-0038
SUGGESTED WIRE GAUGE: 18 AWG
USAGE: Power input supply to Casia system

Pinout

1	VIN
2	VIN
3	GND
4	GND

SERIAL UART

EXTERNAL MARKINGS: UART 1, UART 2
CONNECTOR SERIES: JST GH
MATING CONNECTOR: GHR-06V-S
CRIMP TERMINALS: SSHL-002T-P0.2 (Reel)
SUGGESTED WIRE GAUGE: 28-30 AWG
LOGIC LEVEL: 3.3V
USAGE: Autopilot, ADS-B RX/TX, and Accessories

Pinout

1	5V Out
2	TX
3	RX
4	CTS
5	RTS
6	GND

RS-232 SERIAL

EXTERNAL MARKINGS: RS-232 1, RS-232 2
CONNECTOR SERIES: JST GH
MATING CONNECTOR: GHR-06V-S
CRIMP TERMINALS: SSHL-002T-P0.2 (Reel)
SUGGESTED WIRE GAUGE: 28-30 AWG
USAGE: Autopilot, ADS-B RX/TX, and Accessories

Pinout

1	5V Out
2	TX
3	RX
4	-
5	GND

CAN Bus

EXTERNAL MARKINGS: CAN 1, CAN 2
CONNECTOR SERIES: JST GH
MATING CONNECTOR: GHR-04V-S
CRIMP TERMINALS: SSHL-002T-P0.2 (Reel)
SUGGESTED WIRE GAUGE: 28-30 AWG
USAGE: Autopilot, ADS-B RX/TX, and Accessories

Pinout

1	5V Out
2	CAN H
3	CAN L
4	GND

INDUSTRIAL ETHERNET WITH PoE

EXTERNAL MARKINGS: Cameras 1, 2, 3, 4, 5, 6
CONNECTOR SERIES: Harting/Hirose iX
MATING CONNECTOR (kit): 09451812560XL (solder),
09451812561XL (crimp)
SUGGESTED CABLE SPECIFICATION: CAT 6A
USAGE: Camera interface

Pinout
Standard Pinout

ETHERNET

EXTERNAL MARKINGS: Ethernet
CONNECTOR SERIES: RJ45
MATING CONNECTOR: Standard RJ45
USAGE: Data transfer and software update

Pinout
Standard Pinout

USB 3.1

EXTERNAL MARKINGS: USB 3.1
INTERFACE MODE: Host
CONNECTOR SERIES: USB 3.1 Type A
MATING CONNECTOR: USB 3.1/3.0/2.0 Type
A Plug with Jack Screws
USAGE: Accessories

Pinout
Standard Pinout

USB 2.0

EXTERNAL MARKINGS: </>
INTERFACE MODE: Device
CONNECTOR SERIES: USB 2.0 Micro B
MATING CONNECTOR: USB 2.0 Micro B Jack
USAGE: uAvionix Engineering debug

Pinout
Standard Pinout

HDMI - UAVIONIX USE ONLY

THIS PORT IS RESERVED FOR UAVIONIX USE ONLY.

EXTERNAL MARKINGS: HDMI
CONNECTOR SERIES: Standard HDMI Plug
MATING CONNECTOR: Standard HDMI Jack
USAGE: uAvionix Engineering debug

Pinout
Standard Pinout

MICRO SD

EXTERNAL MARKINGS: Micro SD
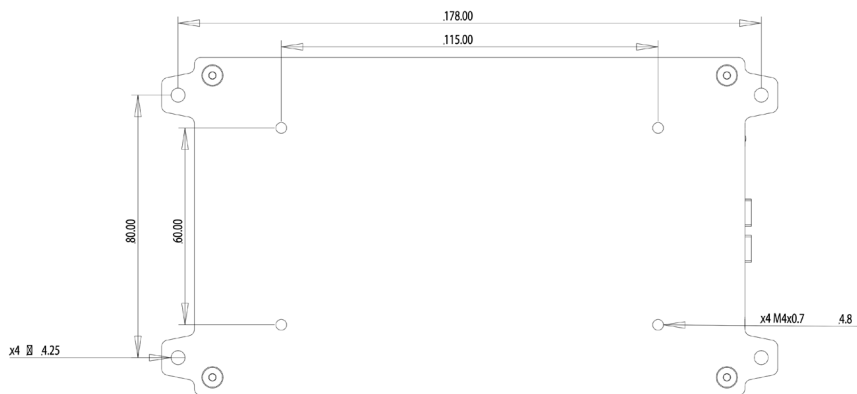CONNECTOR SERIES: Standard Micro SD
USAGE: uAvionix Engineering debug

Pinout
Standard Pinout

MECHANICAL

Footprint and mounting hole pattern for Casia module.

.178.00
.115.00
80.00
60.00
x4 M4x0.7   4.8
x4 ⌀ 4.25

Overall dimensions of Casia module.

CASIA

SERIAL NUMBER   CAMERA STATUS   SYSTEM STATUS
                                                  SW   HW
CAN 1 CAN 2 UART 1 UART 2 RS-232 1 RS-232 2   RECOVER RESET POWER

52.00

188.00

8.9 MP GigE Camera

SPECIFICATION

|	
Input Voltage	**802.3at PoE**
Power	**2.5W Nominal, 3W Peak**
Mass	**Camera (each): ~190g**
	Camera Cambles (1m) ~60g
External Dimensions	**Camera: 60mm (W) x 60mm (L) x 105mm (D)**
*Operating Temperature	**0°C to 60°C**
Storage Temperature	**-45°C to 85°C**
*Ambient Humidity	**85°C / 85% RH, 168 hours**
*Shock	**140G, 2ms**
*Vibration	**10Hz to 200Hz, 1G and 2G RMS**
Aviation Environment	**Visual Meteorological Conditions**
Times of Day	**30 minutes after sunrise**
	30 minutes before sunset
Precipitation	**Nil**
Cloud Coverage	**Okta 0 - 8**
Field of Regard	**Horizontal: Each camera has an 80 degree field of view. The field of regard - assuming 5 cameras - would be 360 degrees, with an overlap of 40 degrees.**
	Vertical: 50 degrees.

* Indicates that testing is ongoing and that these are expected values.

MECHANICAL

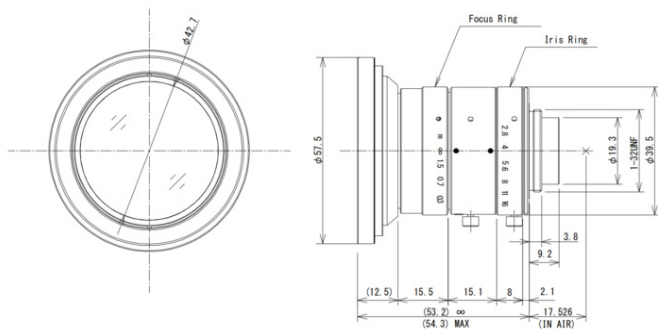Footprint and mount points for FLIR Backfly S family of cameras.

CAMERA BODY:

FLIR Blackfly S
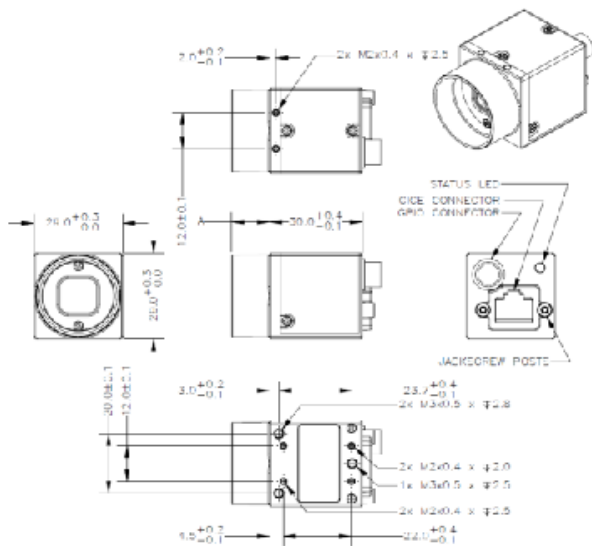
CAMERA LENS:

Dimensions of Computar 8mm Low Distortion C-Mount Lens

Limitations & Disclaimers

Setup and maintenance of Casia must be performed as per the Casia User Guide to ensure that Casia performs optimally. Setup of the Casia System must be verified by an uAvionix Engineer. Contact support@uavionix.com for assistance.

Incorrect camera focus or installation can affect Casia performance:

• If the camera is not focussed correctly, Casia will not detect as specified.

• If the field of view of the camera is partially obscured - for example - by a propeller, wing, or other part of the UAS, or any other object including bugs and water droplets, Casia will not detect as specified.

• Elevation and bearing accuracy of Casia will vary based on the precision of integration of Casia cameras.

Pre and post-flight checks must always be performed as specified in the Casia User Guide.

uAvionix Inc. 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 as part of a layered air risk mitigation approach.

• If Casia has not been 'trained' in an environment similar to yours, performance - including detection rates and the frequency of false positives - may vary from that specified. Casia has been 'trained', tested and performance verified in the following operational environments: Agricultural, forested, desert (with visible features), sparsely populated urban areas, and above canyons. Evaluation of Casia in other environments is ongoing. For such environments, Casia's performance should be assumed to be extremely low / zero until testing is performed. Please contact support@uavionix.com for guidance.

• 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, paraplanes, hot air 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.

- The specified range estimation accuracy assumes automated avoidance maneuvers are enabled. This configuration ensures intruder aircraft do not get as close to the ownship. If automatic avoidance is disabled and intruder aircraft are allowed to get closer to the ownship, it should be assumed that range estimation accuracy decreases.

- Casia does not detect static objects.

The specified Casia performance - particularly the detection rate - 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. Casia should be rebooted between flights to maximize performance.

EMI from Casia may interfere with range and performance of C2 systems. This should be fully evaluated by the operator and, if necessary, advice sought from support@uavionix.com.

Casia X has been trained and tuned to identify and classify small GA aircraft. The above results are specific to the detection of small GA aircraft (small planes and helicopters). Casia I will not perform to the above level when the intruder aircraft are small drones. This is the case even when aircraft scale is considered, as there are many factors involved in Casia I detecting crewed aircraft.

The performance of Casia X will reduce as visibility decreases. See the Casia X User Guide for more information.

Your Casia system should be replaced following a crash or 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.