



C - A S T R A L
AEROSPACE Ltd.

ENDURING - PRECISION!

UNMANNED AIRCRAFT SYSTEMS



C-ASTRAL.COM

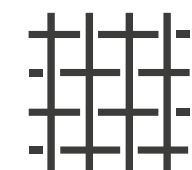


C-ASTRAL Highlights

C-Astral unmanned systems

are much smaller than manned aircraft, easier to maintain and transport and therefore much more cost-effective, providing excellent productivity and fast return on investment.

The industry leading BRAMOR UAS family is electrically powered and is able to achieve superior stability and endurance through its unique advanced Blended Wing Body airframe aerodynamics. It is capable of achieving the most precise surveying results in the small UAS category down to 1,5 cm, with a Ground Sampling Distance that starts at 0,7 cm.



MANUFACTURED FROM

Aerospace certified Kevlar™, Vectran™, carbon composites and honeycomb structural elements. Performance, Style and Form instead of “styrofoam”.



ADVANCED AERODYNAMICS

Blended Wing Body (BWB) airframes with large payload capacity, highest aerodynamic efficiency and long endurance resulting in better productivity. Unrivaled.



ACCURATE REMOTE SENSING

Precision optics and multiple sensor options with INS data logging electronics, enabling a fast, seamless and software agnostic processing chain. ENDURING - PRECISION!



GLOBAL TOOLS NEED GLOBAL SUPPORT

The C-ASTRAL customer service team is here to assist, support and problem solve. support@c-astral.com



C-ASTRAL Applications

THE ULTIMATE SOLUTIONS FOR YOUR MISSION.

ppX

SURVEYING AND REMOTE SENSING

Point cloud derived DSM, DEM, orthomosaic, Aero-photogrammetry, mapping, surveying, volume calculations and estimations.

RGB \ NDVI \ MULTISPECTRAL \ HYPERSPECTRAL

ppX C4EYE

INFRASTRUCTURE CONTROL

Roads and railroads management and control, critical infrastructure monitoring, pipeline and well monitoring, upstream, midstream and downstream monitoring.

RGB \ NDVI \ MULTISPECTRAL \ EYE-X \ gAS

ppX

PRECISION AGRICULTURE

Vigor and health of crops, yield estimation, crop counting and volume calculations, chemical management, plant deconvolution.

RGB \ NDVI \ MULTISPECTRAL \ HYPERSPECTRAL

ppX C4EYE

FLOOD MONITORING

Digital terrain model derived flood simulations and real time flood control.

RGB \ EYE-X

ppX

OPEN PIT MINING

High precision fast revisit time volume and stockpile calculations, infrastructure and machinery control.

RGB \ NDVI \ MULTISPECTRAL \ HYPERSPECTRAL

C4EYE ppX

ECOLOGICAL SENSING

Precise ecosystems status monitoring, speciation, forest management, plant deconvolution, pollutants identification, wildlife monitoring, cryosphere, sea ecosystems monitoring, anti-poaching.

RGB \ NDVI \ MULTISPECTRAL \ EYE-X \ HYPERSPECTRAL \ gAS

C4EYE ppX

CLASSICAL ISR

Target tracking, coordinate estimation, tactical level observation, change detection, tactical mapping and charting, battlefield zone observation, BDA, maneuver estimation and observation, communications relay.

EYE-X \ RGB \ HYPERSPECTRAL \ MULTISPECTRAL

C4EYE ppX

SEARCH AND RESCUE

Video based visible light and thermal sensor based search, coordinate estimation, orbiting observation in the most extreme conditions.

RGB \ NDVI \ EYE-X

ppX

IED CHANGE DETECTION

Forward area infrastructure road and zone of interest mapping and charting, change detection algorithm applications.

RGB \ MULTISPECTRAL \ HYPERSPECTRAL

C4EYE ppX

WILDFIRE MANAGEMENT

Hot zone definition and fire perimeter definition, coordinate estimation, wildfire area mapping and charting, communications relay.

EYE-X \ HYPERSPECTRAL \ NIR

C4EYE ppX

CIVIL DEFENSE

Coordinate estimation, search and rescue coordination, zone of interest orbiting, charting and mapping, damage assessment, communications relay.

RGB \ EYE-X \ HYPERSPECTRAL \ MULTISPECTRAL

C4EYE ppX

FIRE CONTROL

Forward area of operations target estimation, BDA, tactical mapping and charting.

RGB \ EYE-X

SPECIAL OPS
PROVEN

BRAMOR C4EYE



“The Ultimate C4ISR Solution – the most capable and affordable small UAS in its class in the world!”

A NATO OPERATIONS C-ASTRAL USER

IN OPERATIONAL USE ON FOUR CONTINENTS

BATTLEFIELD AND SPECIAL OPS PROVEN

- FEATURES AND APPLICATIONS**
- Long Range (30km+) IP Manet data/videolink
 - Encrypted communication^{OPTIONAL}
 - MANET (Mobile Ad Hoc Network) optional secure digital communications
 - Wildfire management
 - Environmental monitoring
 - Infrastructure control
 - Over the hill observation (LOS)
 - Night surveillance
 - Fire control
 - Civil defense
 - Target detection and tracking
 - Low intensity conflict zone control
 - Search and rescue missions
 - Anti-poaching
 - NGO support missions



RETRACTABLE EYE-X/HD SENSOR

MODULAR AIRFRAME

INTEGRATED PARACHUTE

SUPREME AERODYNAMIC EFFICIENCY



IP VIDEO/DATA RANGE UP TO 30KM

TRACK, GEO-REGISTER OR LOCK TARGETS



BRAMOR C4EYE Sensor Options



MODULAR AIRFRAME

PARACHUTE LANDING SYSTEM

SUPREME AERODYNAMIC EFFICIENCY

OPTIONAL IR BEACONS

- ↳ Up to 3 h endurance
- ↳ Range up to 150 km
- ↳ 100% autonomous
- ↳ Wind resistant up to 30 knots
- ↳ Carbon / Kevlar™ / Vectran™ Construction

A SOVEREIGN C4EYE OPERATOR IN EUROPE



The field proven **BRAMOR C4EYE** UAS line is appropriate for operations where real-time or near real time video observation and surveillance capability is of utmost importance. With an endurance of up to 3 hours, a standard data and payload link of up to 40 km, or the optional MANET digital communications capabilities.

* Flight endurance measured at ICAO standard atmosphere conditions (15 °C / 1013,25 hPa / winds calm), depends on UAS configuration/system weight.

PRODUCT IMAGES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER FROM THE ACTUAL PRODUCT.

“We have put this machines through their paces in battle zone conditions and the MOD has decided that this will be the UAS of choice for future procurement.”

SENSOR OPTIONS

NEW SENSOR AVAILABLE Q3 2018



EYE-X EO/IR/Laser Illuminator Gimbal



EYE-XHD Nose mounted sensor, total 40x continuous zoom

DIMENSIONS

- ↳ wingspan: 230 cm
- ↳ length: 96 cm
- ↳ central module length: 67 cm
- ↳ T/O Weight: 4,5 kg

FEATURES

- ↳ In-flight waypoint management
- ↳ Camera, Altitude, and Target prosecution guidance modes
- ↳ 1-2 person operation
- ↳ Catapult takeoff
- ↳ Accurate parachute landing in a 30 m x 30 m zone
- ↳ Convoy following capability

- ↳ Robust fail-safe system for maximum safety
- ↳ Wind penetration up to 30 knots
- ↳ Flight ready in less than 5 min
- ↳ Ability to track, Geo-register or Lock targets
- ↳ Standard video/data range up to 40 km LOS



TARGET GEO-LOCATION

Accurate geo-location of a target based on its location in a video image is a key functionality provided by the EYE-X gimbal sensor at day and night.

10MP SNAPSHOT

Enables 10MP snapshot stored on-board micro SD card or real-time download from UAV. Video recording is possible on-board as well as off-board. Live snapshot gallery accessible via MANET radio.

“The system performed much better than what we were used to from other UASs and the change detection counter IED workflow saved lives.”

A BRAMOR SYSTEMS INSTRUCTOR FROM A NATO COUNTRY OPERATING IN AFGHANISTAN



VEHICLE TRACKING

Pursue mode continually updates the loiter point around the target to allow the UAV to center its flight path on the target of interest.

HUMAN SIZE OBJECT TRACKING

LASER ILLUMINATOR

Highlight ground targets with the built-in stabilized illuminator.



The **EYE-X EO/IR/Laser Illuminator gimbal** brings the capabilities of much larger UAS systems to the tactical level. Equipped with a 10MP visible light sensor and an industry benchmark thermal imagery uncooled micro-bolometer with an optional laser illuminator, it is capable of detecting, tracking, following and geo-locating targets, objects and features, infrastructure, positions and estimating maneuvers, day and night. It is the sensor of choice for institutional and sovereign customers needing immediate actionable intelligence.

PRODUCT IMAGES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER FROM THE ACTUAL PRODUCT.

FEATURES

- ↳ 10 MP ePTZ CMOS RGB visible light sensor
- ↳ LWIR Uncooled bolometer core FLIR QUARK 640
- ↳ 2x, 4x, 10x zoom capability
- ↳ Full Frame Rate 7,5 Hz (NTSC); 8,3 Hz (PAL)
- ↳ Pixel Pitch 17 µm
- ↳ Spectral band 7,5-13,5 µm
- ↳ QUARK VPC module
- ↳ Brushless electric motor
- ↳ Pan 360°, Tilt 90°
- ↳ Gyro + Software continuous stabilization
- ↳ 300mW laser illuminator (LI) available at 400-2000nm
- ↳ Image stabilization
- ↳ Target tracking and Pursue mode
- ↳ Target geo-location
- ↳ On-board / Off-board Recording

APPLICATIONS

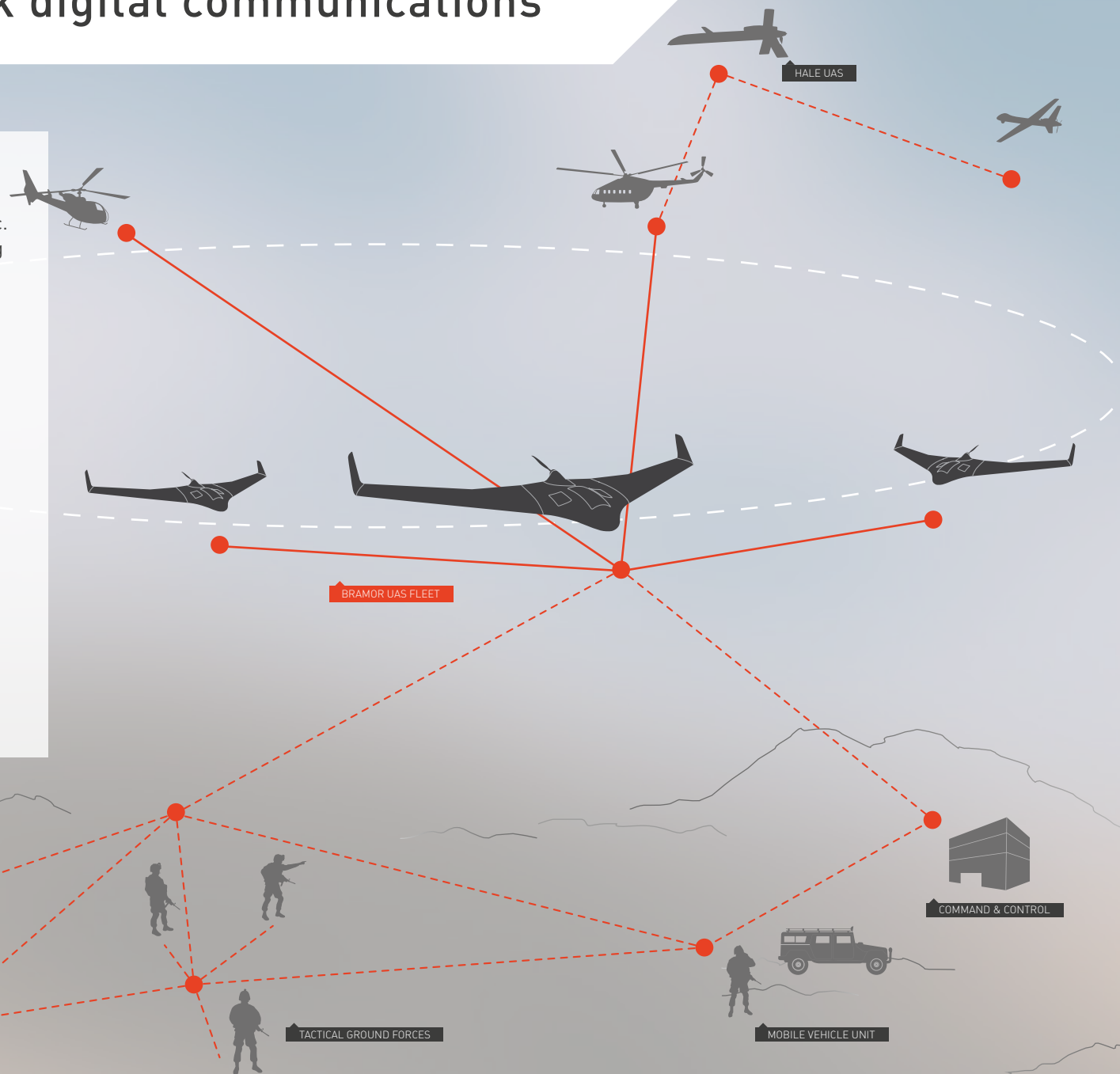
- C4EYE** INFRASTRUCTURE CONTROL, FLOOD MONITORING, ECOLOGICAL MONITORING AND SENSING, CLASSICAL ISR, SEARCH AND RESCUE, WILDFIRE MANAGEMENT, CIVIL DEFENSE, FIRE CONTROL

Tactical network digital communications

For the demanding conditions encountered in operational uses, **C-ASTRAL systems** have been integrated with the TrellisWare Technologies, Inc. TSM™ waveform mobile ad-hoc mesh networking capabilities, enabling seamless scalability and network agility in dynamic environments. TSM waveform networking provides robust performance in challenging environments, and can scale from a few radios to hundreds of units in a single RF channel. It uses Barrage Relay™ networking technology, where all radios collaboratively receive and retransmit multi-hop networking traffic. Sensor data and asset management is available on all tactical and command levels for agile, fast and precise decision making.

The C-ASTRAL TSM waveform equipped systems are completely integrated with the MIL SISTEMIKA C4i battlefield management suites and solutions, supporting several interoperability standards.

www.milsistemika.com



“Advanced signal processing and cooperative communication technologies built from the ground up to deliver the world’s most robust and reliable high-speed wireless IP networking coverage.”

Embedded module	Small form-factor handheld radio	High power tactical communications unit with extended network range
<ul style="list-style-type: none"> ↳ 20 MHz occupied bandwidth, configurable to 4 MHz ↳ 2W TX power ↳ MIL-STD-810G ↳ 8 Mbps IP throughput per channel ↳ AMR 5.9 or MELPe audio encoding ↳ TSM waveform ↳ Barrage Relay routing ↳ Constant envelope modulation 	<ul style="list-style-type: none"> ↳ 20 MHz occupied bandwidth, configurable to 4 MHz ↳ MJPEG or H.264 video encoding ↳ 1 second NET entry time ↳ 2m immersion water resistance ↳ 8 hours battery life ↳ 2W TX power ↳ MIL-STD-810G ↳ 8 Mbps IP throughput per channel ↳ AAC, AMR 5.9 or MELPe audio encoding ↳ TSM waveform ↳ Barrage Relay routing ↳ Constant envelope modulation 	<ul style="list-style-type: none"> ↳ 20 MHz occupied bandwidth, configurable to 4 MHz ↳ Multi network gateway between channels ↳ Monitors dual independent networks ↳ 8W TX power ↳ Splash proof ↳ MIL-STD-810G ↳ 8 Mbps IP throughput per channel ↳ AMR 5.9 or MELPe audio encoding ↳ TSM waveform ↳ Barrage Relay routing ↳ Constant envelope modulation

TrellisWare, TSM and Barrage Relay are trademarks of TrellisWare Technologies, Inc., registered in the U.S.



WORKFLOW PHASES



MISSION PLANNING



FLIGHT & DATA COLLECTION



DATA & IMAGE EXPORT



ONLINE FLIGHT LOGBOOK

DATA PROCESSING

C-ASTRAL PILOT C³P SOFTWARE

- Ergonomic touch screen GUI
- Critical flight control data always present on screen
- Seamless and fast mission planning
- In-flight systems monitoring
- Area, mission time, GSD and precision estimation
- Failsafes management
- System health monitoring
- Real-time camera feedback

COMPATIBLE WITH

- 3D SURVEY
- ENSO MOSAIC
- AGISOFT PHOTOSCAN
- PIX4D MAPPER
- PIENEERING
- MENCİ

SIMPLE FLIGHT PLANNING

FUNCTIONAL GUI MODES

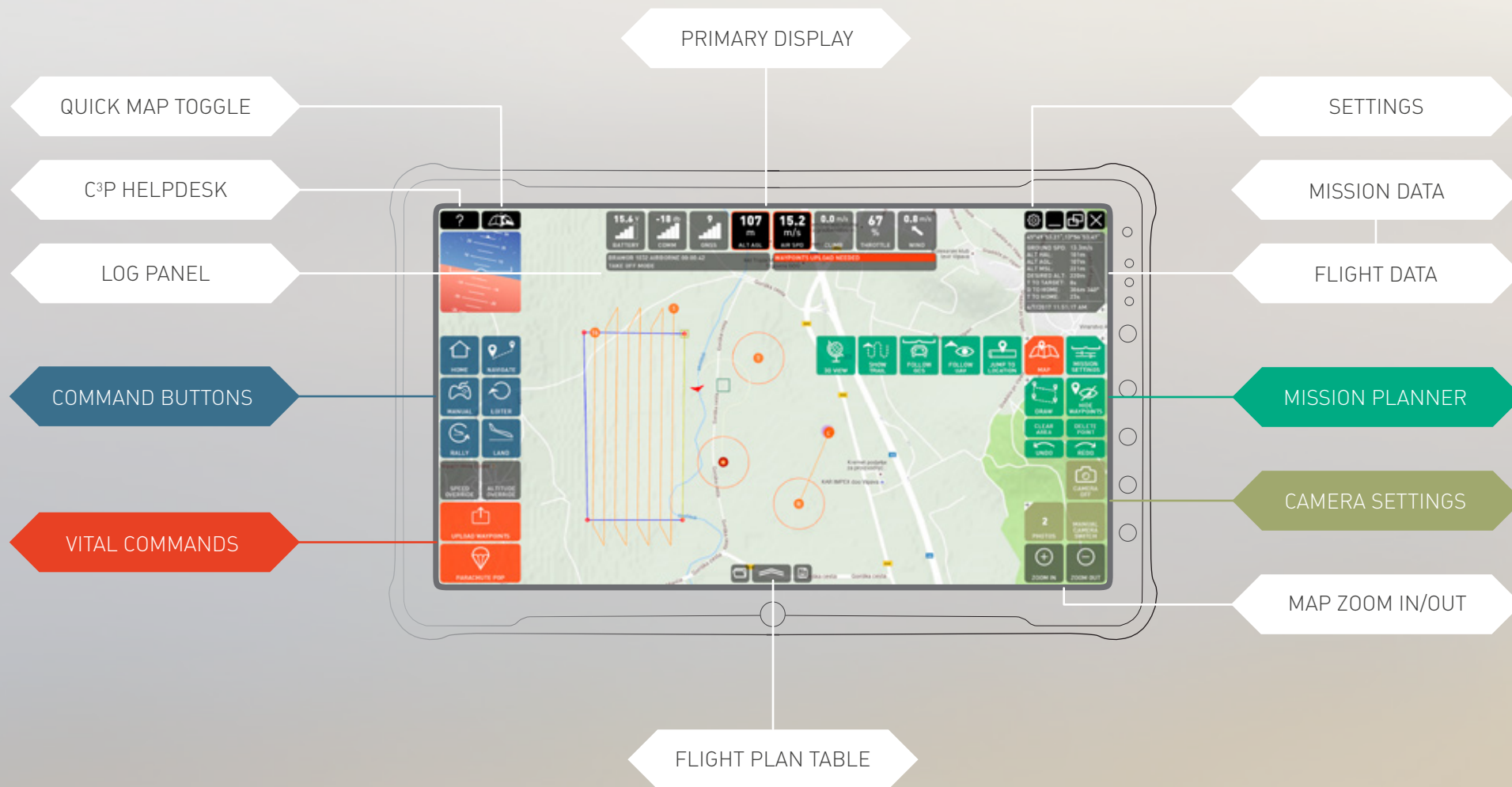
REAL-TIME IN-FLIGHT SYSTEMS MONITORING





C-ASTRAL C³P Software Features

ONE SOFTWARE – MULTIPLE PLATFORMS



C³P ppX MODE

- Multi-geometry ad-hoc mission planning
- Transect planning
- Polygon planning
- Corridor planning
- Quick access to critical flight control commands
- Constant image acquisition quality monitoring
- Flight data display
- Failsafe controls



C³P C4EYE MODE

- Pre-planned or live control flight modes
- Quick access to critical flight control commands
- Target tracking
- Convoy following
- Sensor data and still image recording
- Flight data display
- Failsafe controls
- Altitude mode flying
- Loiter mode flying
- Target centric flying



BRAMOR ppX

FEATURES

- Accuracy down to 0,6 cm
- Fast initialization
- RTK datalink independent
- Up to 3,5 h flight time*
- 100% Autonomous
- Exchangeable sensors
- Imaging control computer

GNSS SURVEY GRADE RECEIVER

POWERED BY  septentrio

ppX BASE STATION^{OPTIONAL}

POWERED BY  septentrio

C-ASTRAL PILOT C³P

- Mission planning
- Command, Control & Communications
- Real-time system health monitoring
- Failsafes management

SURVEY GRADE IMU^{OPTIONAL}



MICRO GCS SX-101

* Flight endurance measured at ICAO standard atmosphere conditions (15 °C / 1013,25 hPa / winds calm), depends on UAS configuration/system weight.



BRAMOR ppX Sensor Options



CARBON / KEVLAR™ / VECTRAN™ CONSTRUCTION

GNSS SURVEY GRADE RECEIVER

- Post Processing Kinematic
- Integrated IMU^{OPTIONAL}
- L1&L2 (L5 ready) GNSS receiver
- Fast initialization
- RTK datalink independent
- Accuracy down to 0,6 cm**

PITOT CLEANING AND OBSTRUCTION CONTROL SYSTEM

LONG RANGE DATA LINK ANTENNAS

NAVIGATION LIGHTS^{OPTIONAL}

INTEGRATED SENSOR (MULTIPLE OPTIONS)



DIMENSIONS

- Wingspan: 230 cm
- Length: 96 cm
- Central module length: 67 cm
- T/O Weight: 4,7 kg

- Wind resistance 30 knots
- Compatible with RINEX Base data

One flight coverage estimation

- 15 km² / 600 m AGL / 7,8 cm GSD
- 2 km² / 200 m / 2,6 cm GSD

FEATURES

- 100% Autonomous
- Automatic parachute landing
- Orography capable flight planning with GSD maintenance over slopes, hills and valleys
- Safe catapult launch

ppX Specifications

- UAV location accuracy down to 0,6 cm.
- Onboard survey grade L1&L2 GNSS receiver
- GPS, GLONASS, BeiDou, Galileo ready

The **BRAMOR ppX** (GNSS PPK - Post Processing Kinematic) UAS is ideally suited for surveying and remote sensing applications that need a fast high precision set of results, down to sub-centimeter GSD level also in the absence of a grid of ground control points.

* Flight endurance measured at ICAO standard atmosphere conditions (15 °C / 1013,25 hPa / winds calm), depends on UAS configuration/system weight.
 ** Standard accuracy: 2xGSD Horizontal, 3xGSD Vertical achieved with proper planning (80% overlap, 80% sidelap, good light conditions).

PRODUCT IMAGES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER FROM THE ACTUAL PRODUCT.

“We would not have been able to map more than 300 km of a remote railway line in Ethiopia in a week without Bramor’s capability to acquire data without a preplaced grid of ground control points.”

JAN ZOREC, KOBALE SURVEYING SERVICES





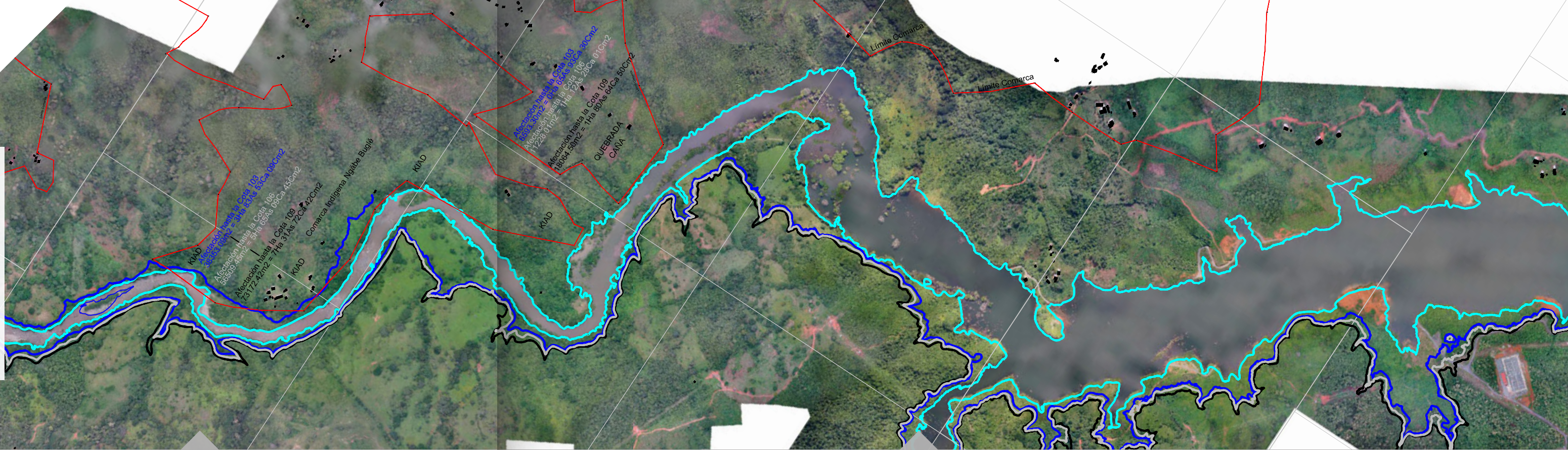
Bramor ppX RGB Sensor 24,3MP

LAND SURVEY WITH THE HELP OF AN UNMANNED AERIAL VEHICLE (UAV) WITH 3DSURVEY

Whitepaper by Vid Petрман, Modri Planet d.o.o., Ljubljana, Slovenia
Email: vid.peterman@modriplanet.si

Bramor ppX accuracy assessment resulted in the mean error for X/Y = 6 mm and for Z = 24 mm.**

P1	0,017	0,007	-0,025	0,031
P2	-0,001	0,002	-0,009	0,010
P3	-0,005	-0,004	0,020	0,021
P4	-0,004	-0,008	0,018	0,020
P5	-0,021	0,010	-0,050	0,055
P6	-0,010	-0,000	-0,040	0,041
P7	0,007	-0,001	-0,023	0,024
P8	0,005	0,004	-0,004	0,007
P9	0,005	-0,002	0,031	0,031



24,3 MP RGB

Map a large area in a single flight with high precision lenses.
Ground Sampling Distance down to 0,7 cm.

CONTOUR LINES

Generate contour lines from pointclouds.

DSM

Generate high precision Digital Surface Model from your RGB dataset.



The **RGB 24,3 megapixel sensor** enables precise visible light survey grade mapping, aero-photogrammetry and dense point cloud data acquisition for digital terrain models, digital surface models, volume and stockpile calculations. With 30 mm and optional 19 mm optics, sub-centimeter GSD acquisition is enabled.

** Standard accuracy: 2xGSD Horizontal, 3xGSD Vertical achieved with proper planning (80% overlap, 80% sidelap, good light conditions).

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PROJECT:

Quantification of the plots of land affected by the flood level of Barro Blanco hydroelectric dam - Republic of Panama.

PROJECT MANAGER:

Surveyor Juan Maggi Company: Geomap Inc. - Ingenieria del Territorio - Panamá

Mission area coverage estimation and ground sampling distances for the BRAMOR ppX

100	1,3	2,5
200	2,6	5,0
300	3,9	7,5
400	5,2	10,0
500	6,5	12,5
600	7,8	15,0

APPLICATIONS

ppX

SURVEYING AND REMOTE SENSING, INFRASTRUCTURE CONTROL, PRECISION AGRICULTURE, FLOOD MONITORING, OPEN PIT MINING, CLASSICAL ISR, SEARCH AND RESCUE, IED CHANGE DETECTION, WILDFIRE MANAGEMENT, CIVIL DEFENSE, FIRE CONTROL, ECOLOGICAL MONITORING AND SENSING

Location: Panamá

Area: 16 km²

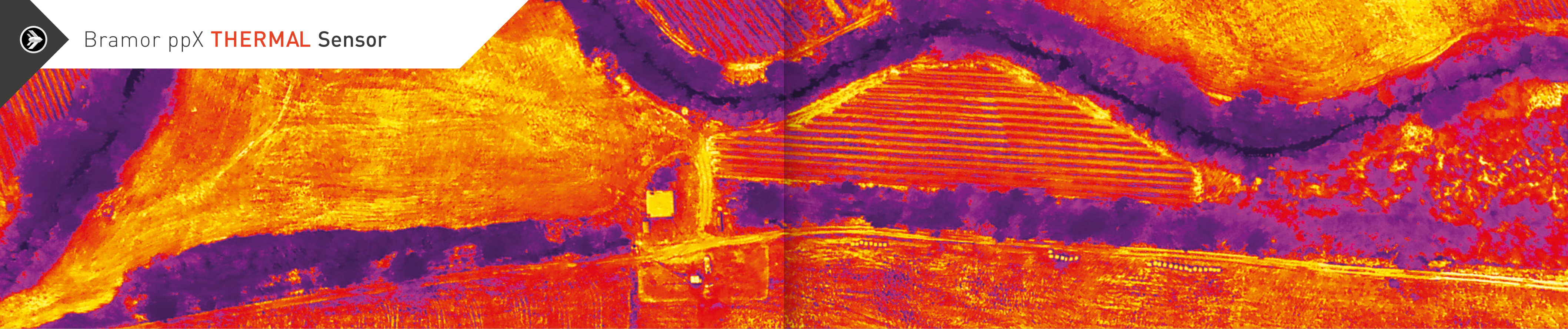
Flight time: 3 x 2 h

Flight altitude AGL: 532 m

GSD Resolution: 6,65 cm / pix



Bramor ppX **THERMAL** Sensor



RADIOMETRIC IMAGERY

Factory calibrated for accurate temperature measurements from an airborne perspective

LENS OPTIONS

9mm, 13mm, 19mm

MEASUREMENT ACCURACY

+/-5°C or 5% of reading in -25°C to +135°C range
+/-20°C or 20% of reading in -40°C to +550°C range

SPECTRAL BAND

7.5 - 13.5 µm

FLIR DUO PRO R



THERMAL FUSION

The **Thermal Sensor** is suitable to gather accurate, non-contact temperature measurements from an aerial perspective. Every still image contains calibrated temperature data embedded in every pixel, resulting in decision making support for precision agriculture, forestry, building and roof inspections, power grid inspections, infrastructure analysis, and public safety.

FLIR DUO PRO R FEATURES

- ✎ Airborne dual sensor thermal and video imaging and recording in a single component
- ✎ On-board GPS receiver, IMU, temperature, humidity, and altitude sensors
- ✎ Spectral Band 7.5 - 13.5 µm
- ✎ Thermal Frame Rate 30 Hz
- ✎ Resolution: 640 x 512 pixel (thermal) | 4000 x 3000 pixel (visual)

THERMAL FUSION FEATURES

- ✎ Digital thermal radiometric and visual data stored on microSD card
- ✎ Per pixel temperature measurements
- ✎ Hot Spot Detection
- ✎ Geo-referenced data material
- ✎ Thermal Frame Rate 9 Hz
- ✎ Resolution: 640 x 512 pixel (thermal) | 1600 x 1200 pixel (visual)

APPLICATIONS

ppX SURVEYING AND REMOTE SENSING, PRECISION AGRICULTURE, OPEN PIT MINING, SEARCH AND RESCUE, WILDFIRE MANAGEMENT, CIVIL DEFENSE, DAMAGE ASSESSMENT, ECOLOGICAL MONITORING AND SENSING, SECURITY OPERATIONS, HIGH LEVEL INDUSTRIAL INSPECTIONS

Location: **Slap, Slovenia**

Area: **8 km²**

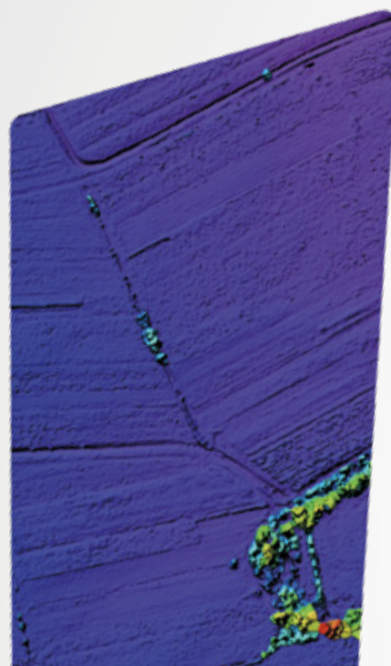
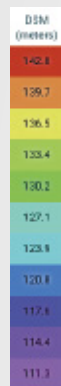
Flight time: **2,5 h**

Flight altitude AGL: **100 m**

GSD Resolution: **0,2 cm/pixel**



Bramor ppX **Multispectral sensors**



RGB

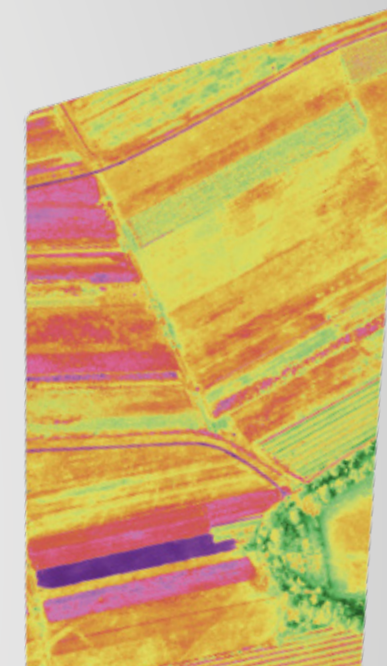
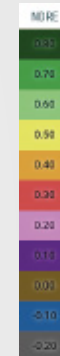
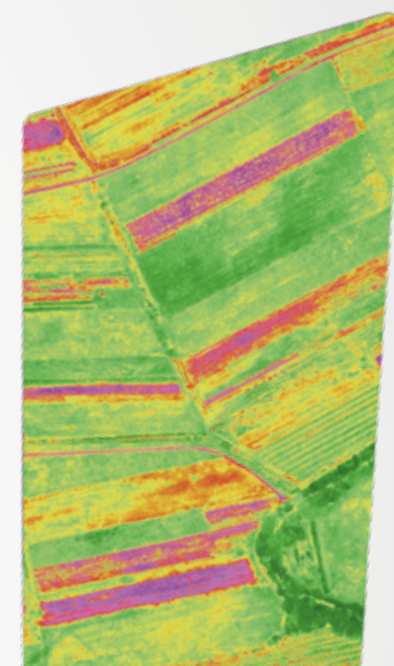
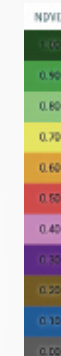
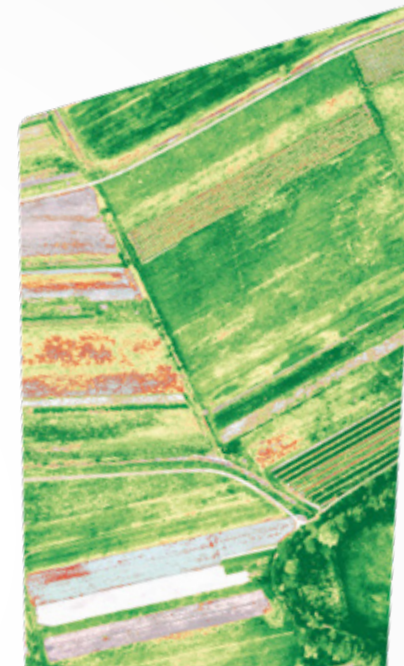
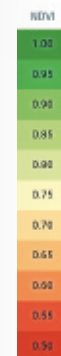
Red Green Blue: This is a true color representation of the studied (field) area.

DSM

Digital Surface Model can be used to visualize changes in topography or measure the height of plant / tree above the surrounding terrain.

CIR

Color Infrared (or Near Infrared) layer helps you to visualize the amount of infrared light reflected.



NDVI

Normalized Difference Vegetation Index is an index for visualizing vegetation health. Areas with NDVI values greater than 0,5 are colored using a red/yellow/green color scale. The NDVI reveals variability in plant vigor and biomass, often times not visible in standard RGB color imagery. With NDVI2 a new color scale is applied, in which values below 0,5 are not hidden, like they are in the NDVI layer. This allows to visualize all NDVI values within the studied field.

NDVI2

NDRE

Normalized Difference Red Edge Index can be a valuable index when collecting data and monitoring stress /health over mature plants. The advanced vegetation indices like NDRE are more sensitive to changes in leaf chlorophyll content and provide information about plant nutrient status.

“This is a revolutionary vegetation vision instrument. We can map 1500 hectares in a single flight.”



MS-RE

MS-SQ

The **BRAMOR ppX** mounted MS-RE sensor simultaneously captures five discrete spectral bands, enabling the creation of tailored indices for high end vegetation mapping. The compact MS-SQ sensor can be carried simultaneously with one of C-ASTRAL's high resolution sensors and features four narrowband filters optimized for analyzing crop health and a 16 MP RGB imager for easy digital scouting. Its irradiance sensor and integrated GPS make it an accurate, compact and calibrated tool for precision agriculture.

PRODUCT IMAGES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER FROM THE ACTUAL PRODUCT.

MS-RE FEATURES

- 5 spectral bands: Blue, green, red, red edge, near IR
- Calibrated for precise, repeatable measurements
- Ground Sample Distance: 8,0 cm per pixel at 120 m AGL
- Capture Rate: 1 per second
- Narrowband optical filters provide full imager resolution for each band
- 32GB Memory: Single SD card stores all images with geotags
- Wi-Fi capable device web-based interface

MS-SQ FEATURES

- 4 spectral bands, 10 bits Global shutter
- Self-calibrated using the Sunshine sensor
- Ground Sample Distance 12,4 cm Monoband, 2,7 cm RGB
- Capture Rate: 1 per second
- RGB Camera 16MP Rolling shutter
- 64GB Memory / IMU + Magnetometer + GPS
- Configuration over Wi-Fi

APPLICATIONS

ppX SURVEYING AND REMOTE SENSING, INFRA-STRUCTURE CONTROL, PRECISION AGRICULTURE, FLOOD MONITORING, OPEN PIT MINING, CLASSICAL ISR, SEARCH AND RESCUE, IED CHANGE DETECTION, WILDFIRE MANAGEMENT, CIVIL DEFENSE, FIRE CONTROL, ECOLOGICAL MONITORING AND SENSING

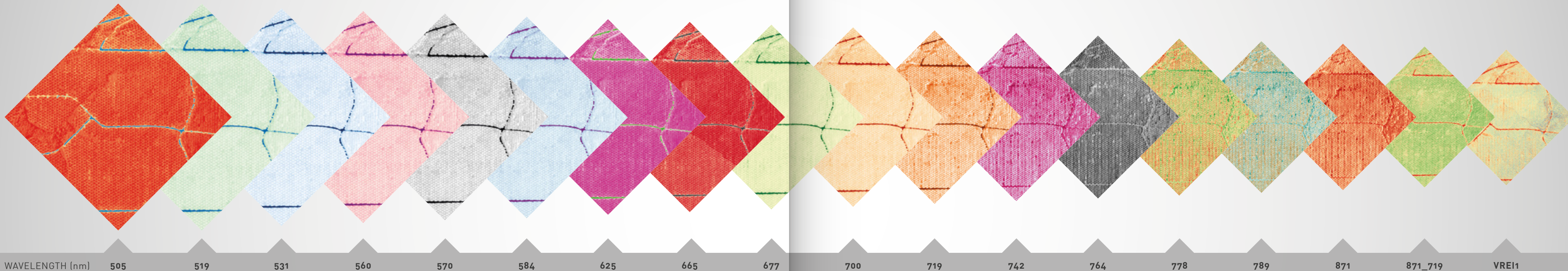
Location: Vipava, Slovenia | Area: 0,3 km² | Flight time: 20 min | Flight altitude AGL: 100 m | GSD Resolution: 12,4 cm Monoband 2,7 cm RGB



Bramor ppX **gHY** Sensor

OIL PALM PLANTATION

“The world’s smallest and most lightweight system with a functional hyperspectral camera.”



The **gHY sensor** creates 2D spectral information in VIS-VNIR spectral range with single exposure and enables mosaicking with photogrammetric software. The sensor provides real response in each pixel without interpolation. This high end sensor is, due to it’s spectral range, especially suitable for uses in agriculture, forestry and water research for unrivaled results and precision.

FEATURES

- ↳ Hyperspectral imager
- ↳ VIS-VNIR snapshot
- ↳ F-number: ~ 2,8
- ↳ Focal length: 9 mm
- ↳ Ground pixel: 6,5 cm at 100 m altitude
- ↳ Default spectral range: 500-900 nm
- ↳ Other ranges: 400 - 700, 450 - 800, 550 - 950 nm
- ↳ Spectral resolution: \uparrow 10 nm, FWHM
- ↳ Spectral step: 1 nm
- ↳ Spectral bands: ~ 380 max
- ↳ Dynamic range: 12 bits
- ↳ Exposure time: 0,06-3000 ms
- ↳ Frame rate: 30 frames/s
- ↳ Max Image dim: 1010 x 1010 pix
- ↳ Sensor 1010 * 1010 pixels for each band, CMOS, 5,5 * 5,5 microns / pixel
- ↳ FOV: 37 degrees
- ↳ Exposure time: integration time 5 - 15 ms / band, 30 bands /s (1010*648 pixels)

APPLICATIONS

ppX SURVEYING AND REMOTE SENSING, INFRA-STRUCTURE CONTROL, PRECISION AGRICULTURE, FLOOD MONITORING, OPEN PIT MINING, CLASSICAL ISR, SEARCH AND RESCUE, IED CHANGE DETECTION, WILDFIRE MANAGEMENT, CIVIL DEFENSE, FIRE CONTROL, ECOLOGICAL MONITORING AND SENSING

Location: **Indonesia**

Area: **2 km²**

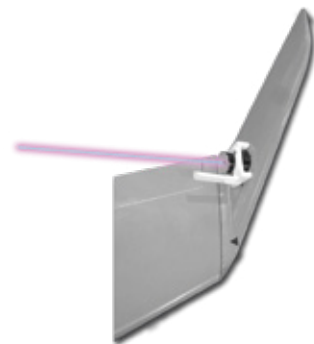
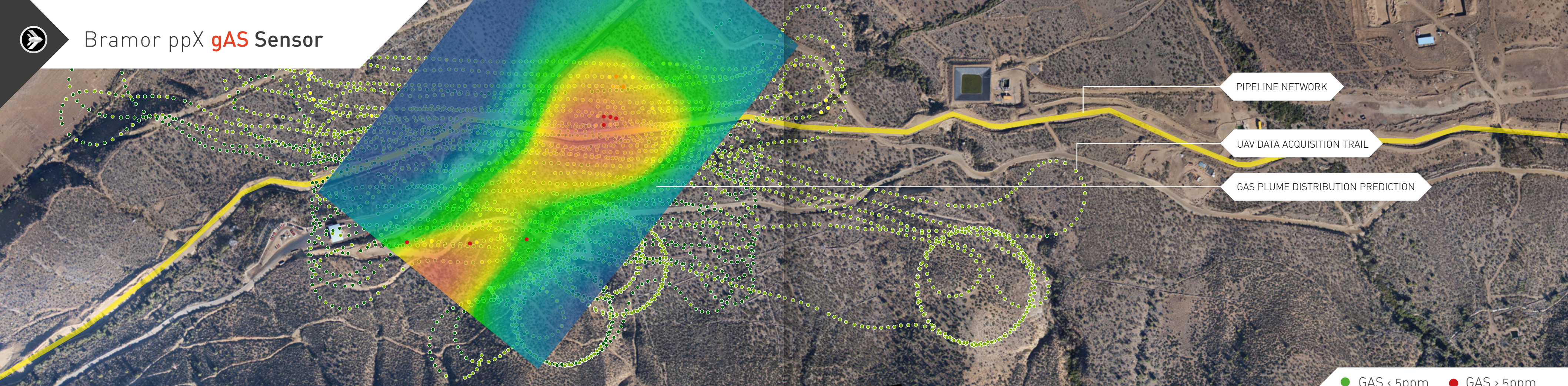
Flight time: **60 min**

Flight altitude AGL: **100 m**

GSD Resolution: **6,5 cm**



Bramor ppX **gAS** Sensor



The **gAS sensor** option on the ppX aircraft is a unique and extremely capable high resolution, excellent selectivity long range methane leak detection system, based on a proven DFB tunable diode laser absorption spectroscopy system adapted to UAS use from larger manned platforms. Developed in collaboration with gas detection industry leaders Boreal Laser and C-ASTRAL partners Ventus Geospatial, this system revolutionizes pipeline, oil and gas well and other methane and noxious gases detection and compliance operations.

PRODUCT IMAGES ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER FROM THE ACTUAL PRODUCT.

FEATURES

- ↳ Remote molecular level gas detection down to 0,05 ppm CH₄
- ↳ 2,5h flight time
- ↳ 110km operational range
- ↳ Plume estimation and mapping
- ↳ 1 reading per second, default alarm 10ppm
- ↳ No consumables, minimum sensor maintenance
- ↳ Additional multispectral and 16MP RGB sensor option
- ↳ ADS-B transponder option
- ↳ Long range solar power extended range option

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Location: **South America** Area: **8 km²** Flight time: **45 min** Flight altitude AGL: **65 m** Accuracy: **< 0,05 ppm (CH₄)**



Bramor System Package



ppX

Basic Bramor ppX system package consists of:

- ✎ BRAMOR ppX airframe
- ✎ Micro GCS SX101 stand-alone magnetic GCS unit
- ✎ Rugged mission planning and command and control computer
- ✎ Flight case transportation system
- ✎ CAT 1 elastic launching system
- ✎ Recovery parachute (2 units) with protective packs
- ✎ Set of basic spares (carbon tubes, accessories, 1 extra propeller)
- ✎ Battery charger (including cables for GCS and Li-Po)
- ✎ Training in Slovenia (excluding lodging & transportation costs)
- ✎ Documentation & Manuals



OPTIONAL ENHANCEMENTS:

- ✎ Septentrio GNSS Base station
- ✎ 400Hz high precision IMU
- ✎ ADS-B S-Mode Transponder
- ✎ Emergency Beacon Locator
- ✎ Cat 2 Pneumatic launching system
- ✎ ASTRALTRACK-M antenna
- ✎ NAV / STROBE lights
- ✎ Visibility stickers

ppX TRANSPORTATION SYSTEM



AIRFRAME/GCS CASE

- ✎ Interlockable with catapult case
- ✎ External size (LxWxH): 122 x 52 x 28 cm



CATAPULT CASE

- ✎ Wheels for single man transportation
- ✎ External size (LxWxH): 122 x 52 x 28 cm

C4EYE

Basic Bramor C4EYE system package consists of:

- ✎ BRAMOR C4EYE airframe
- ✎ KJ-200 rugged GCS
- ✎ Flight case transportation system
- ✎ CAT 1 catapult launcher
- ✎ ASTRALTRACK-M antenna
- ✎ Recovery parachute (2 units) with protective packs
- ✎ Set of basic spares (carbon tubes, accessories, 1 extra propeller)
- ✎ Battery charger (including cables for GCS and Li-Po)
- ✎ Documentation & Manuals



OPTIONAL ENHANCEMENTS:

- ✎ GCS - ADV2X Portable dual screen ground control station and other configurations
- ✎ Touchscreen option with composite video input
- ✎ AC/DC adapter
- ✎ Power supply, external VGA option for portable GCS
- ✎ RADICAL-40X automatic high power antenna GCS/combination
- ✎ NAV / STROBE lights
- ✎ Visibility stickers
- ✎ 2x Water resistant backpack

C4EYE TRANSPORTATION SYSTEM



AIRFRAME/GCS CASE

- ✎ Interlockable with catapult case
- ✎ External size (LxWxH): 122 x 52 x 28 cm



CATAPULT CASE

- ✎ Wheels for single man transportation
- ✎ External size (LxWxH): 122 x 52 x 28 cm



Optional enhancements



CAMERA MOUNTED IMU


The VN-100 incorporates an assortment of inertial sensors, including a 3-axis accelerometer, 3-axis gyroscope, 3-axis magnetometer, and a barometric pressure sensor.

- 0.5° Static Pitch/Roll
- 1.0° Dynamic Pitch/Roll
- 5°/hr Gyro In-Run Bias (typ.)
- 800 Hz IMU Data




EMERGENCY BEACON LOCATOR

- Find the location of your system with a built-in VHF beacon and handheld receiver.




NAV / STROBE LIGHTS

- Anti collision strobe lights
- Navigational lights



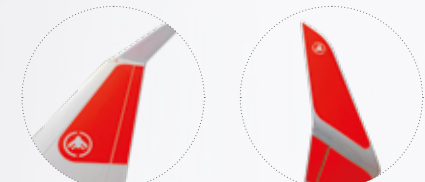
ADS-B S-MODE TRANSPONDER

- Make your UAV visible to other cooperating traffic and air traffic control.



CAT 2 PNEUMATIC LAUNCHING SYSTEM


- For cold weather operations (-20°C).
- Aluminum lightweight folding pneumatic catapult including a compressor & an electronic valve.



VISIBILITY STICKERS


- Make your UAV more visible with the fluorescent sticker scheme

Modularity, adaptation and system flexibility are the key features of the **C-ASTRAL BRAMOR UAS** family.




RADICAL-40X ANTENNA SYSTEM

- Automatic tracking technology (auto-orientating) with integrated GCS
- Compatible with analog or digital C-Astral communication links
- Weather resistant
- Tripod / mast / vehicle or roof mounted




ASTRALTRACK - M ANTENNA

- Manual tracking technology
- Compatible with analog or digital C-Astral communication links
- Lightweight



MANET RADIOS

- High-speed wireless IP networking
- Network relay to send and receive IP data
- 1775-1815 MHz, 2200-2250 MHz
- MIL-STD-810G
- TSM™ waveform
- SOCOM approved
- Barrage relay™ routing
- Constant envelope modulation
- IPv4, IPv6, Unicast, Multicast, Broadcast, TCP, UDP IP support
- 8 Mbps throughput per channel



WATER RESISTANT BACKPACK

- Heavy duty whole system water resistant carrying backpack for ppX and C4EYE systems
- Detachable system for up to 3 airframes



Bramor UAS Technical data

COMMERCIAL DESIGNATION	BRAMOR C4EYE		BRAMOR ppX			
SENSING TECHNOLOGY	C-Astral EYE-X	EYE-XHD	24,3 RGB	42 RGB <small>(available Q2 2018)</small>	Multispectral	gAS
			24,3 CIR/NDVI		FLIR Pro R Duo / Thermal Fusion	Hyperspectral
WINGSPAN	230 cm					
LENGTH	96 cm					
AIRCRAFT TYPE & AIRFRAME	Fixed wing, Blended Wing Body configuration, Kevlar™ reinforced carbon and Vectran™ composite airframe					
AVIONICS	Lockheed Martin	Lockheed Martin and C-ASTRAL ORTHOelectronics				
PROPULSION	C-Astral brushless electric					
MTOW	3,8 - 4,7 kg					
PAYLOAD	0,6 - 1,0 kg					
CRUISE SPEED	16 m/s					
Vne	30 m/s					
TAKEOFF SYSTEM	ELASTIC LAUNCHER / PNEUMATIC LAUNCHER					
LANDING AREA	30 m x 30 m					
LANDING	PARACHUTE					
SERVICE CEILING	demonstrated up to 5000m ASL					
VIDEO & DATALINK RANGE	Up to 40 km LOS with the C-Astral directional antennas					
ENDURANCE*	up to 3 hours (demonstrated)	up to 3,5 hours (demonstrated)				
T/O READINESS	System T/O ready in less than 5 minutes					
TRANSPORT	2 MILSPEC backpacks and / or rugged transportation cases					
OPERATOR REQ	one or two operators					
FLYING	100% autonomous from takeoff to landing					
GIMBAL CONTROL	flight stick control					
ORTHOPHOTO CONTROL	100% autonomous, multiple orthophoto mission geometries possible in 1 flight, reprogrammable on the fly while vehicle in the air					
MANUAL FLIGHT CONTROL	optional flight stick					
GCS ENDURANCE	up to 10 h					
EMERGENCY FAIL-SAFES	yes, user configured					
TRAINING	custom arrangement	5 day training in Slovenia, special training arrangements are possible				



“There is no better system on the market that can achieve this accuracy, productivity and flexibility that Bramor can do for us.”

Jose Marcos Perez Diaz, UAS manager at Airdrone 3D



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web: www.smartlineaerial.com

MEXICO

OCULUS AIRBORNE SENSING
tel: +52 1 (55) 1294 7309
web: www.oculusairbornesensing.com

“BRAMOR ppX delivers a staggering 3,5 hours of flight endurance - more than double of most other UAVs.”

ASTRON ENVIRONMENTAL SERVICES PTY LTD





C - A S T R A L
AEROSPACE Ltd.

ENDURING - PRECISION!

C-Astral is an aerospace solutions provider based in Ajdovscina, Slovenia, the “hub” of advanced aerospace development and integration in this part of Central Europe.

The company is a global market leader with established reputation in the specialized, fixed wing small Unmanned Aircraft Systems (UAS) manufacturing and services field, with a specific focus on high productivity, endurance, surveying and remote sensing. C-Astral’s customer base is diversified between the commercial UAS operators, larger institutional networks, scientific users as well as government entities. Currently, C-Astral systems are flying with six sovereign entities on force protection, border protection, fire control and surveillance operations on four continents and more than 100 commercial and scientific operators globally. C-Astral established a multidisciplinary software and hardware laboratory for aerodynamics and systems integration work and a prototyping CAD/CAM workshop facility for composite materials manufacturing and modeling. The founders of C-Astral have been active in aerospace since 1999 and have been pioneering UAS integrated solutions ahead of the market curve. C-Astral systems are now flying over all continents, including extreme environments such as high altitude open-pit mines, deserts, mountains, Antarctica, over the Arctic and global agricultural lands.



C - A S T R A L
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