



C - A S T R A L
AEROSPACE Ltd.

ENDURING - PRECISION!

UNMANNED AIRCRAFT SYSTEMS



C-ASTRAL.COM

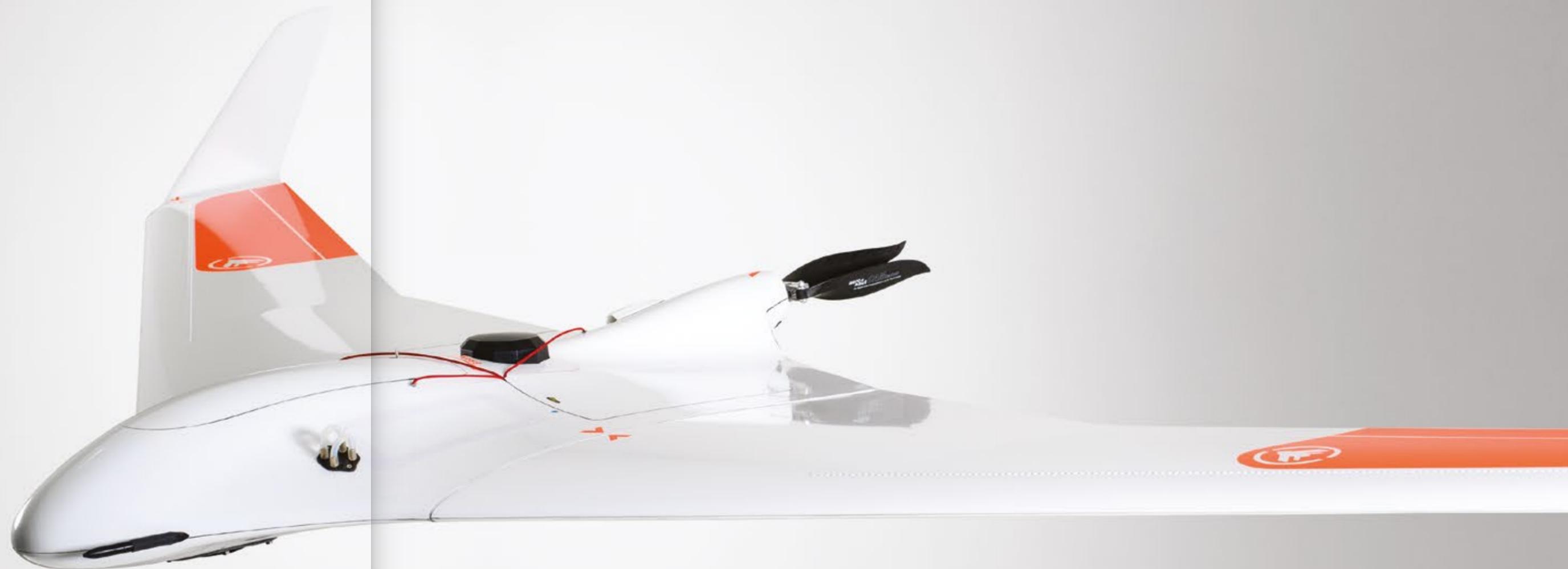


C-ASTRAL Highlights

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!

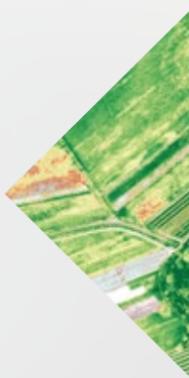


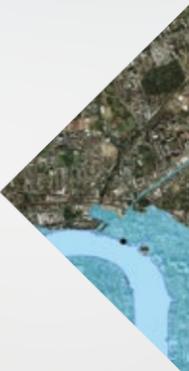
GLOBAL TOOLS NEED GLOBAL SUPPORT

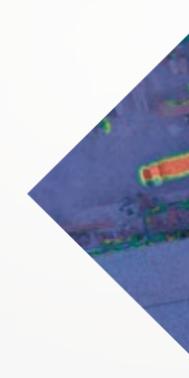
The C-ASTRAL customer service team is here to assist, support and problem solve. support@c-astral.com



THE ULTIMATE SOLUTIONS FOR YOUR MISSION.

<p>ppX</p> <h3>SURVEYING AND REMOTE SENSING</h3> <p>Point cloud derived DSM, DEM, orthomosaic, Aero-photogrammetry, mapping, surveying, volume calculations and estimations.</p> 	<p>ppX C4EYE</p> <h3>INFRASTRUCTURE CONTROL</h3> <p>Roads and railroads management and control, critical infrastructure monitoring, pipeline and well monitoring, upstream, midstream and downstream monitoring.</p> 	<p>ppX</p> <h3>PRECISION AGRICULTURE</h3> <p>Vigor and health of crops, yield estimation, crop counting and volume calculations, chemical management, plant deconvolution.</p> 
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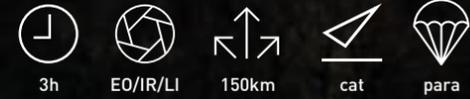
<p>ppX C4EYE</p> <h3>FLOOD MONITORING</h3> <p>Digital terrain model derived flood simulations and real time flood control.</p> 	<p>ppX</p> <h3>OPEN PIT MINING</h3> <p>High precision fast revisit time volume and stockpile calculations, infrastructure and machinery control.</p> 	<p>C4EYE ppX</p> <h3>ECOLOGICAL SENSING</h3> <p>Precise ecosystems status monitoring, speciation, forest management, plant deconvolution, pollutants identification, wildlife monitoring, cryosphere, sea ecosystems monitoring, anti-poaching.</p> 
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<p>C4EYE ppX</p> <h3>CLASSICAL ISR</h3> <p>Target tracking, coordinate estimation, tactical level observation, change detection, tactical mapping and charting, battlefield zone observation, BDA, maneuver estimation and observation, communications relay.</p> 	<p>C4EYE ppX</p> <h3>SEARCH AND RESCUE</h3> <p>Video based visible light and thermal sensor based search, coordinate estimation, orbiting observation in the most extreme conditions.</p> 	<p>ppX</p> <h3>IED CHANGE DETECTION</h3> <p>Forward area infrastructure road and zone of interest mapping and charting, change detection algorithm applications.</p> 
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<p>C4EYE ppX</p> <h3>WILDFIRE MANAGEMENT</h3> <p>Hot zone definition and fire perimeter definition, coordinate estimation, wildfire area mapping and charting, communications relay.</p> 	<p>C4EYE ppX</p> <h3>CIVIL DEFENSE</h3> <p>Coordinate estimation, search and rescue coordination, zone of interest orbiting, charting and mapping, damage assessment, communications relay.</p> 	<p>C4EYE ppX</p> <h3>TARGET ESTIMATION</h3> <p>Forward area of operations target estimation, BDA, tactical mapping and charting.</p> 
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SPECIAL OPS
PROVEN

BRAMOR C4EYE



IN OPERATIONAL USE ON FOUR CONTINENTS

BATTLEFIELD AND SPECIAL OPS PROVEN

FEATURES AND APPLICATIONS

- Long Range (30km+) IP Manet data/videolink
- Encrypted communication
- 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

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

A NATO OPERATIONS C-ASTRAL USER

INTEGRATED PARACHUTE

SUPREME AERODYNAMIC EFFICIENCY

IP VIDEO/DATA RANGE UP TO 40KM

RETRACTABLE EYE-X HD2 SENSOR

MODULAR AIRFRAME

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
- ↳ Capable of operating in 30kt winds
- ↳ 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 40km LOS, 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 NOW



EYE-X EO/IR/Laser Illuminator Gimbal



EYE-XHD2 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
- ↳ 30kt sustained wind penetration
- ↳ Flight ready in less than 5 min
- ↳ Ability to track, Geo-register or Lock targets
- ↳ Standard video/data range up to 40 km LOS



Bramor C4EYE **EYE-X** Sensor



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.



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 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



The **EYE-X gimbals** bring the capabilities of much larger UAS systems to the tactical level. Equipped with high resolution EO and IR sensor with an optional laser illuminator, capable of detecting, tracking, following and geo-locating targets, objects, features and infrastructure, day and night.

EYE-X GIMBAL

- ↳ Belly mount
- ↳ 10 MP ePTZ CMOS RGB visible light sensor
- ↳ LWIR Uncooled bolometer core FLIR QUARK 640
- ↳ 2x, 4x, 10x zoom capability
- ↳ Gyro + Software continuous stabilization
- ↳ 300mW laser illuminator (LI) available at 400-2000nm
- ↳ Target tracking, Pursue mode and Geo-Location
- ↳ On-board / Off-board Recording

EYE-X HD2 GIMBAL

- ↳ Nose mount
- ↳ EO Resolution: 1280 x 720
- ↳ EO zoom: 20x + 2x digital (total 40x) continuous
- ↳ IR Resolution: 640 x 480 (BH/WH toggle)
- ↳ IR zoom: 4x digital
- ↳ Gyro + Software continuous stabilization
- ↳ IR Laser pointer available at 850nm
- ↳ Target tracking, Pursue mode and Geo-Location
- ↳ NETD better than 0.05°C
- ↳ On-board / Off-board Recording

DRI – Visible Channel	DETECT	RECOGNIZE	IDENTIFY
MAN	> 5 km	> 3 km	> 1.5km
VEHICLE	> 20 km	> 5 km	> 3 km
DRI – Thermal Channel	DETECT	RECOGNIZE	IDENTIFY
MAN	370 m	144 m	72 m
VEHICLE	1150 m	400 m	200 m

APPLICATIONS

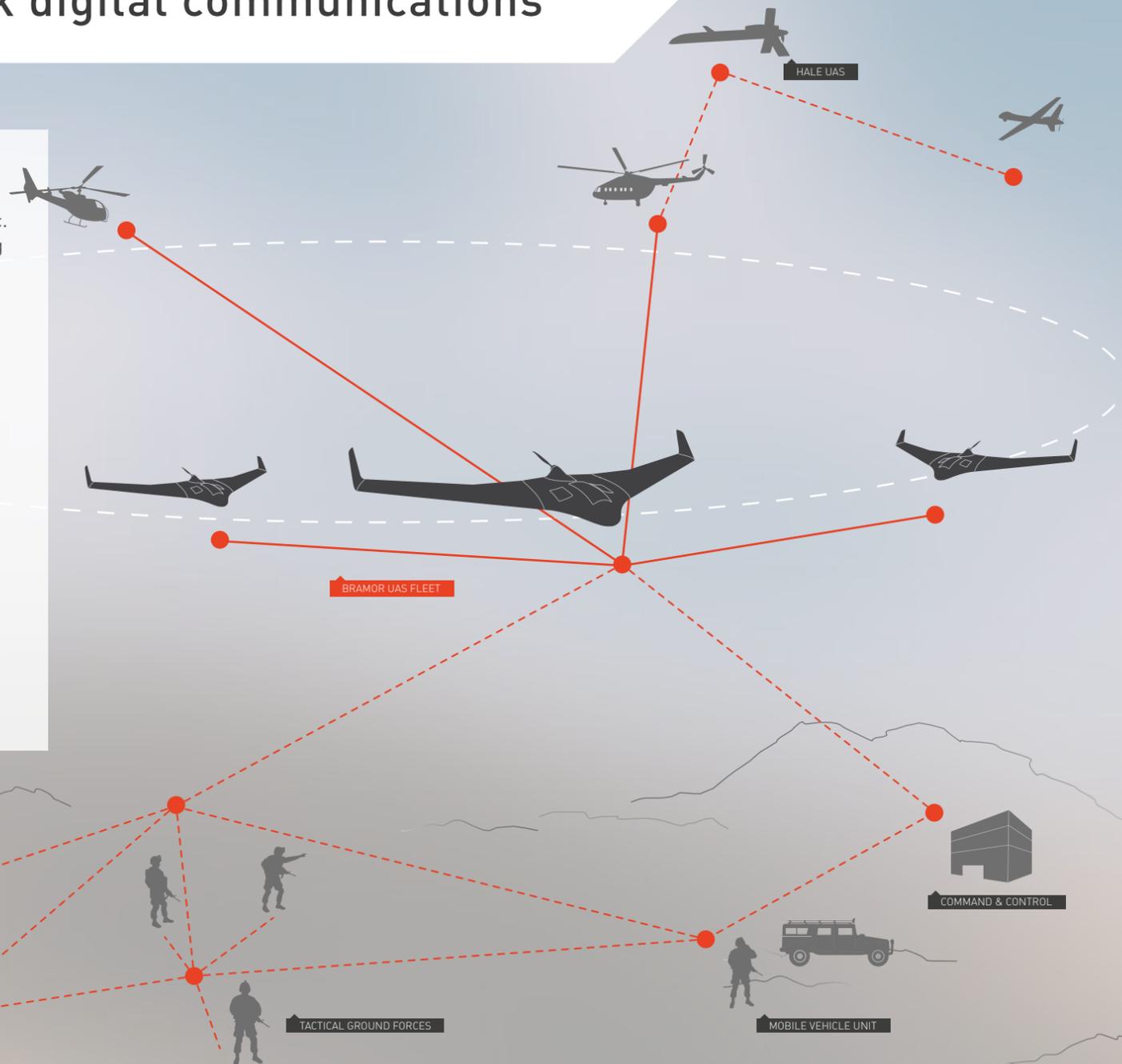
C4EYE INFRASTRUCTURE CONTROL, FLOOD MONITORING, ECOLOGICAL MONITORING AND SENSING, CLASSICAL ISR, SEARCH AND RESCUE, WILDFIRE MANAGEMENT, CIVIL DEFENSE, FIRE CONTROL

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

- ↳ 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

Small form-factor handheld radio

- ↳ 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

High power tactical communications unit with extended network range

- ↳ 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 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
- MENC1

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 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

- up to 3,5h
- multi sensor
- 150km
- 15km²
- cat
- para



CARBON / KEVLAR™ / VECTRAN™ CONSTRUCTION

GNSS SURVEY GRADE RECEIVER

- Post Processing Kinematic
- Integrated IMU^{OPTIONAL}
- L1&L2 (Optional - L5 ready) GNSS receiver
- Fast initialization
- RTK datalink independent
- Maximum ppk accuracy (horizontal 0,6 cm + 0,5 ppm, vertical 1 cm +1 ppm)**

PITOT CLEANING AND OBSTRUCTION CONTROL SYSTEM

LONG RANGE DATA LINK ANTENNAS

NAVIGATION LIGHTS^{OPTIONAL}

INTEGRATED SENSOR (MULTIPLE OPTIONS)

- SINGLE RGB / CIR / NDVI
- AVAILABLE NOW** FULL FRAME 42 MP SENSOR
- AVAILABLE NOW** ALTUM
- HYPERSPECTRAL
- gAS
- FLIR DUO PRO R
- THERMAL FUSION

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

- 32 km² / 800 m AGL / 10,0 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, Optional: BeiDou, Galileo ready

“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, KOBALÉ SURVEYING SERVICES



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 of post processed product

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



Bramor ppX RGB Sensor

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

42 MP / 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.

24,3 MP



42 MP

The Fullframe **RGB 42 megapixel sensor** or **24,3 MP sensor** enable 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.

** 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

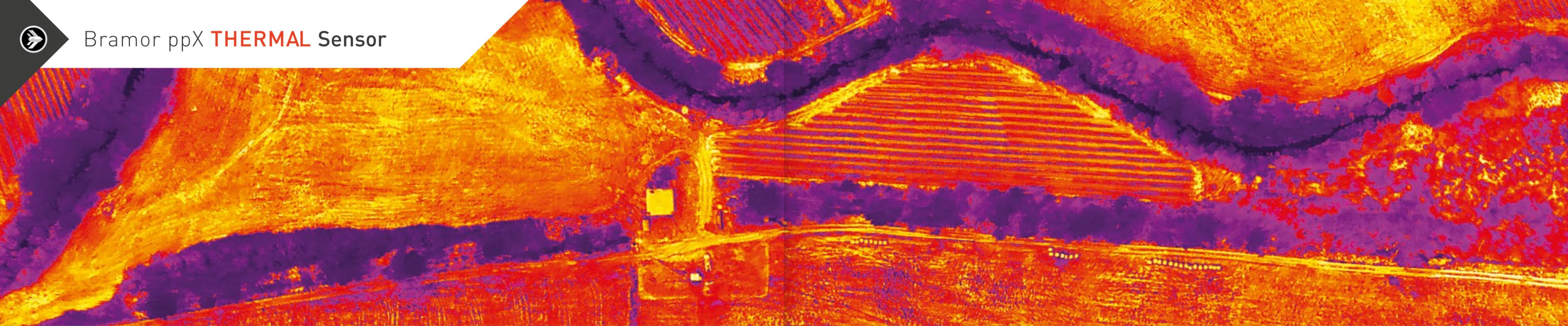
Location: Panamá Area: 16 km² Flight time: 3 x 2 h Flight altitude AGL: 532 m GSD Resolution: 6,65 cm / pix

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



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



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**

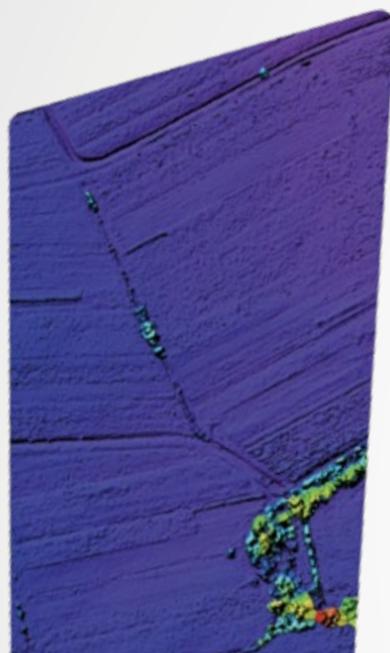
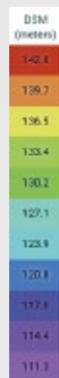
Flight time: **2,5 h**

Flight altitude AGL: **100 m**

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



Bramor ppX **Multispectral sensors**



RGB

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

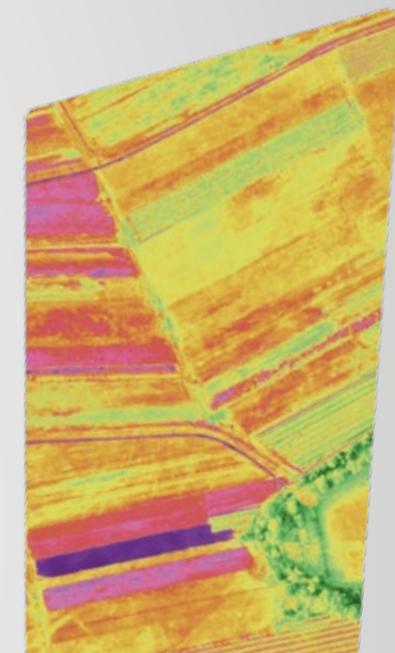
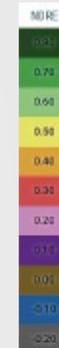
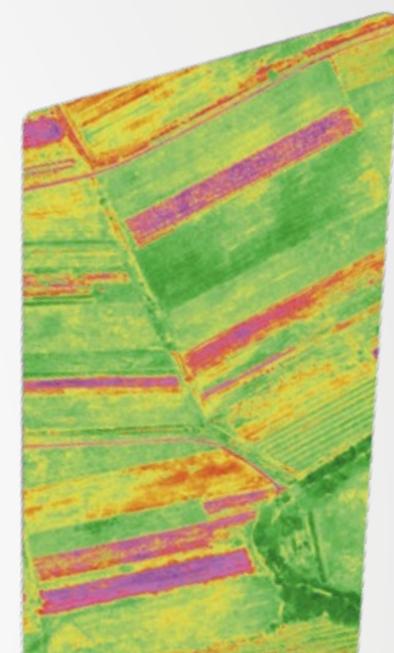
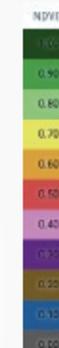
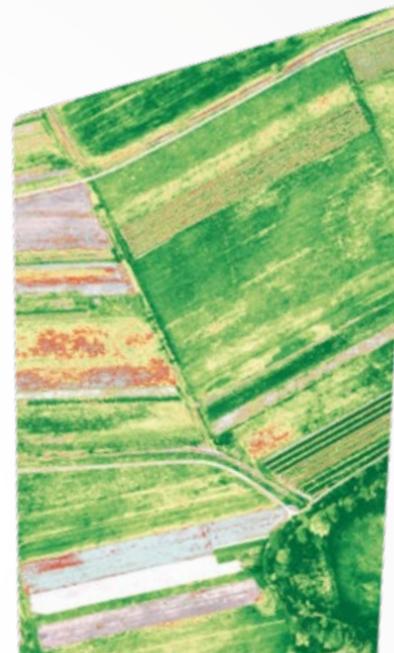
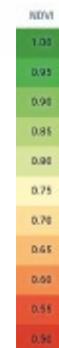
DSM

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.

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



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.



MS-RE

NEW!



ALTUM

The **BRAMOR ppX** mounted multispectral sensors simultaneously capture five discrete spectral bands, enabling the creation of tailored indices for high end vegetation mapping. The new **ALTUM** sensor enables the synchronization of thermal and multispectral imagery combining three calibrated sensors in one. The **BRAMOR ppX** with the **ALTUM** is the most powerful precision agriculture remote sensing tool on the market, capable of covering more than 2000 ha in one flight with dramatically reduced post processing times.

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

ALTUM

- Spectral bands:EO: Blue, green, red, red edge, NIR
- LWIR: thermal infrared 11 um
- Ground Sample Distance: 5.2 cm per pixel (per EO band) at 120 m (~400 ft) AGL 81cm per pixel (thermal) at 120m
- Capture Rate: 1 capture per second1 (all bands), 12-bit RAW
- High capacity USB 3.0 storage
- Digital light sensor with integrated GPS

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

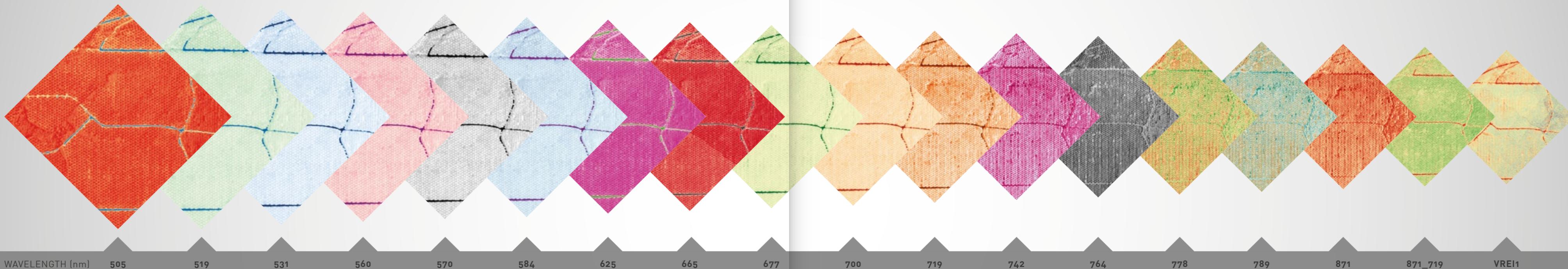
Location: Vipava, Slovenia Area: 0,3 km² Flight time: 20 min Flight altitude AGL: 100 m GSD Resolution: 12,4 cm Monoband 2,7 cm RGB



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**

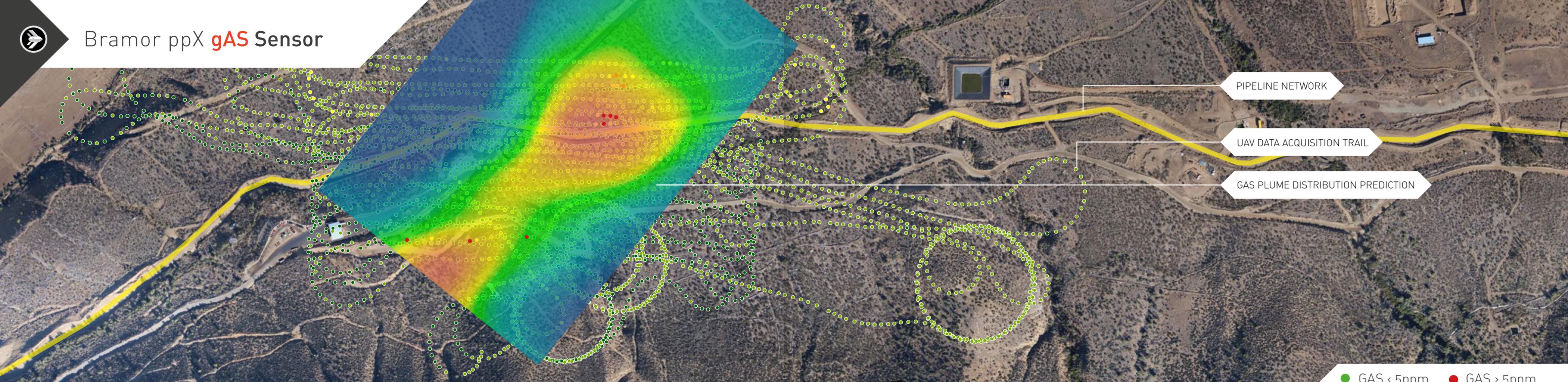
Flight time: **60 min**

Flight altitude AGL: **100 m**

GSD Resolution: **6,5 cm**



Bramor ppX **gAS** Sensor

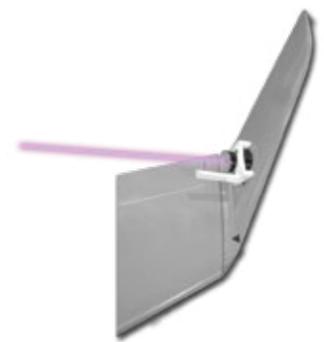


PIPELINE NETWORK

UAV DATA ACQUISITION TRAIL

GAS PLUME DISTRIBUTION PREDICTION

● GAS < 5ppm ● GAS > 5ppm



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.

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

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: **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

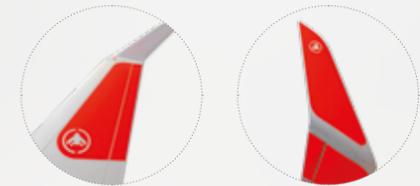


CATAPULT CASE

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



Optional enhancements

<p>ppX</p>  <p>CAMERA MOUNTED IMU</p> <p>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.</p> <ul style="list-style-type: none"> 0.5° Static Pitch/Roll 1.0° Dynamic Pitch/Roll 5°/hr Gyro In-Run Bias (typ.) 800 Hz IMU Data 	<p>C4EYE ppX</p>  <p>EMERGENCY BEACON LOCATOR</p> <ul style="list-style-type: none"> Find the location of your system with a built-in VHF beacon and handheld receiver. 	<p>C4EYE ppX</p>  <p>NAV / STROBE LIGHTS</p> <ul style="list-style-type: none"> Anti collision strobe lights Navigational lights
<p>C4EYE ppX</p>  <p>ADS-B S-MODE TRANSPONDER</p> <ul style="list-style-type: none"> Make your UAV visible to other cooperating traffic and air traffic control. 	<p>C4EYE ppX</p>  <p>CAT 2 PNEUMATIC LAUNCHING SYSTEM</p> <ul style="list-style-type: none"> For cold weather operations (-20°C). Aluminum lightweight folding pneumatic catapult including a compressor & an electronic valve. 	<p>C4EYE ppX</p>  <p>VISIBILITY STICKERS</p> <ul style="list-style-type: none"> 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.

<p>C4EYE ppX</p>  <p>RADICAL-40X ANTENNA SYSTEM</p> <ul style="list-style-type: none"> 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 	<p>C4EYE ppX</p>  <p>ASTRALTRACK - M ANTENNA</p> <ul style="list-style-type: none"> Manual tracking technology Compatible with analog or digital C-Astral communication links Lightweight 	<p>C4EYE</p>  <p>MANET RADIOS</p> <ul style="list-style-type: none"> 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 	<p>C4EYE ppX</p>  <p>WATER RESISTANT BACKPACK</p> <ul style="list-style-type: none"> Heavy duty whole system water resistant carrying backpack for ppX and C4EYE systems Detachable system for up to 3 airframes
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Bramor UAS Technical data

COMMERCIAL DESIGNATION	BRAMOR C4EYE		BRAMOR ppX			
SENSING TECHNOLOGY	C-Astral EYE-X	EYE-XHD2	24,3 MP RGB	42 MP FULLFRAME RGB <small>(AVAILABLE NOW!)</small>	Multispectral and combined MS + Thermal	gAS
			24,3 MP 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



C-ASTRAL Sales Partners

C-ASTRAL HEADQUARTERS / SALES TEAM

email: sales@c-astral.com / tel: +386 5 85 00 840 / web: www.c-astral.com

ITALY

EUROLINK SYSTEMS
tel: +39 06 619 1401
web: www.eurolinksystems.com

BELGIUM, NETHERLANDS, LUXEMBOURG, FRANCE

DRONE PROVIDE S.A.R.L.
tel: +352 2899 1020
web: www.droneprovide.com

EASTERN EUROPE, BULGARIA, CIS

BULCOMERS KS Ltd.
tel: +359 882 028 688
web: www.bulcomersks.com

JAPAN

NIPPON KAIYO
tel: [81] 3-5613-8901
web: www.nipponkaiyo.co.jp

USA (ppX)

SURVEYORS SOURCE
tel: +1 602 274-2052
web: www.surveyorssource.com

USA (C4EYE & ppX)

PLANET INHOUSE, INC.
tel: +1 800 827 1353
web: www.planetinhouse.com

CENTRAL AND LATIN AMERICA

C-ASTRAL CLA
tel: +1 305 586 5101 +507 65508310
web: www.c-astral.com/la

MEXICO

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

BRASIL (ppX)

SOMENGE
tel: +55 11 2787 6391
web: www.somenge.com.br

SOUTH AFRICA (ppX)

AFGEN
tel: +27 11 466 2055
web: www.afgen.co.za

NEW ZEALAND

SYNERGY POSITIONING SYSTEMS
tel: +64 9 476 5151
web: www.synergypositioning.co.nz

SOUTH-EAST ASIA

CWT AEROSPACE SERVICES PTE. LTD
tel: +65 6262 6888
web: www.cwtlimited.com

SAUDI ARABIA, QATAR, BAHREIN, KUWAIT, UAE, IRAQ

ROBOTICS CENTRE
tel: +1 613 755 2280
web: www.robotics-centre.com

CHINA (ppX)

BEIJING ZHENG NENG SPACE TEC.Co.Ltd.
tel: +86 010 802 552 71
web: www.zhengnengspace.com

TURKEY

ATAY MÜHENDISLIK TEKNİK İŞLEMLER
tel: 00903 12 212 2211
web: www.ataymuhendislik.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
AEROSPACE Ltd.

C-Astral d.o.o. // Tovarniska cesta 26, SI-5270 Ajdovscina, Slovenia // sales@c-astral.com // www.c-astral.com

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