Drone requirements

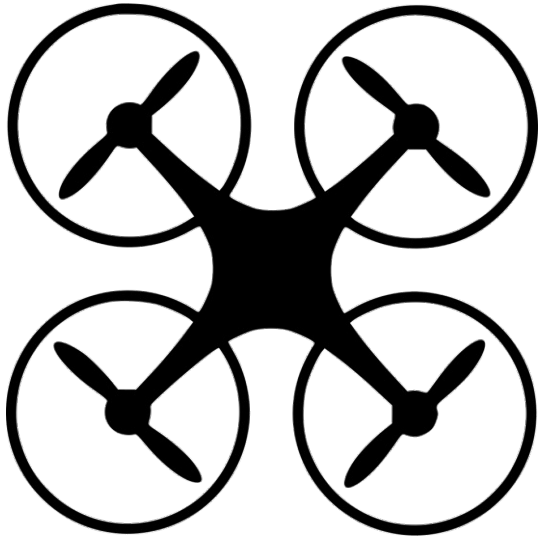
Suitable for aerial agriculture survey

For Harsh environment

Fault Tolerant

Future Proof

Expandable



Precise Positioning

Long-Lasting Battery

Semi-Autonomous

Geotagging

Equipped with Thermal and Multi-Spectral camera

Mechanics

Frame: LJI Z975

- Diagonal wheelbase: 975mm
- Suitable Propeller: 18"
- Net weight: about 1250g

Electronics

BATTERY:2 xTattu 22000mAh 22.2V 30C 6S1P Lipo BatteryPack

- Capacity: 22000mAh
- Voltage: 22.2V/6S
- Discharge Rate: 30C
- Weight: 2460g
- Size: 206*91*61mm
- Total Energy: 976Wh

Avionics

Motors: T-MotorMN501-S

- 5.2 KG Trust
- IP45 Dustproof and Waterproof
- certification
- Impact Resistant

GPS:2 xSIRIUS RTK GNSS ROVER(F9P + RM3100)

- 1cm position accuracy, a convergence time under 10 seconds and a navigation update
- rate up to 20Hz.
- RM3100 Professional Grade Magnetometer
- GNSS-Based Dual-Antenna Heading Augmentation for Attitude and Heading Reference Systems (requires two units)

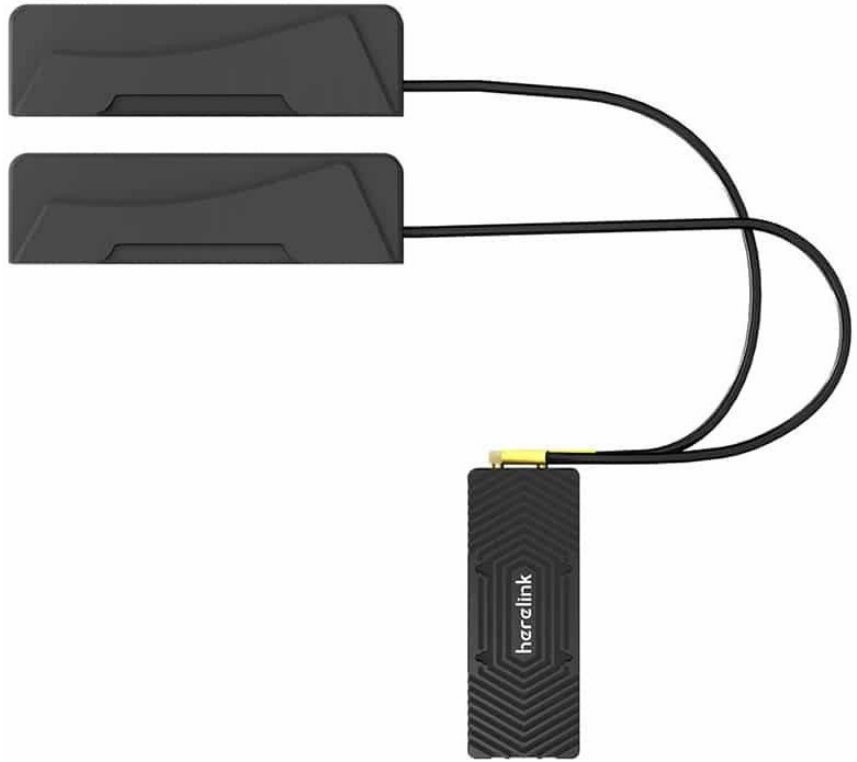
ESC:T-Motor Alpha 40A 6S FOC

- Field oriented Control
- Anti-Corrosion
- Dust/Waterproof
- Active Breaking

Video Transmission

VIDEO TX: Herelink - Air Unit

- Video-Input: Micro HDMI x 2: Input for external camera video, supports 720P 30fps & 1080P 30/60fps
- Power Input: 2 Pin interface. Average power consumption of the single-sided module is less than 4W
- Telemetry: 3 Pin interface x 1:3.3V / 5V level UART interface Mavlink Compatible
- Control Output: 4 Pin interface x 1: Two 3.3V level RC output connectors (S.bus in phase, S.bus inverting or PPM signal output, ground terminal control)
- USB: Micro USB x 1: for debugging upgrades, support OTG mode
- Antenna: MMCX antenna jack x 2: used for signal transmission and ground communication
- Transmission Distance: FCC 20km CE / SRRC 12km Image transmission delay: ≤ 110ms Image
- transmission: 720p@30fps 1080p@30 / 60fps transmission, signal bandwidth 20MHz / 10MHz



Sensors

TERMOCAMERA FLIR VUE PRO 336

- 8Bit Digital video Output
- 14Bit Images stored on removable microSD
- MavLink commands and data compatibility for geo-tagging
- Remote controls using PWM signals
- Spectral Band: 7,5 – 13,5 µm
- HDMI output @1280 × 720 a 50 Hz, 60 Hz

MULTISPETTRALE MICASENSE REDEDGE M

- Calibrated multispectral imagery
- DLS 2 light sensor with global shutter
- Blue (475 nm center, 32 nm bandwidth),
- green (560 nm center, 27 nm bandwidth),
- red (668 nm center, 14 nm bandwidth),
- red edge (717 nm center, 12 nm bandwidth),
- near-IR (842 nm center, 57 nm bandwidth)
- GSD 8 cm per pixel (per band) at 120 m (~400 ft) AGL
- 1 capture per second (all bands), 12-bit RAW
- MavLink commands and data compatibility for geo-tagging
- Remote controls using PWM signals

ULTRASONIC SENSOR

- Features of the MB1202, I2CXL-MaxSonar-EZ0, include centimeter resolution, the widest and most sensitive beam pattern of any unit from the I2CXL-MaxSonar-EZ sensor line, short to long distance detection, range information from 25cm to 765cm, up to a 40Hz read rate, and an I2C interface.

Avionics

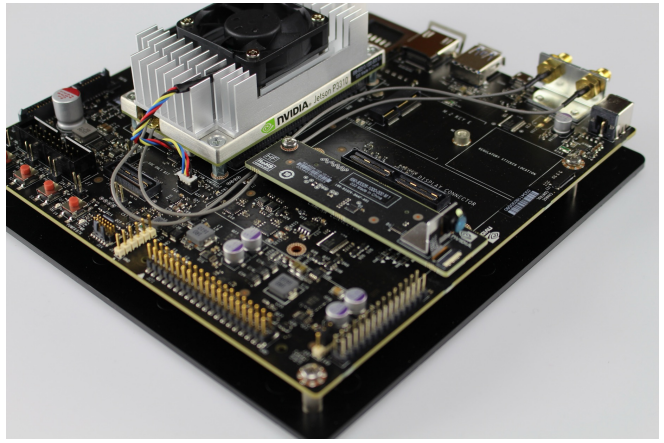
FC: The Cube Orange with ADS-B Carrier Board

- 32bit STM32H743ZI 400 MHz, Flash 2MB, RAM 1MB).
- 32bit STM32F103 failsafe co-processor
- 14 PWM / Servo outputs
- Abundant connectivity options for additional peripherals (UART, I2C, CAN)
- Integrated backup system for in-flight recovery and manual override with dedicated processor and stand-alone power supply
- Redundant power supply inputs and automatic failover
- microSD card for high-rate logging over extended periods of time

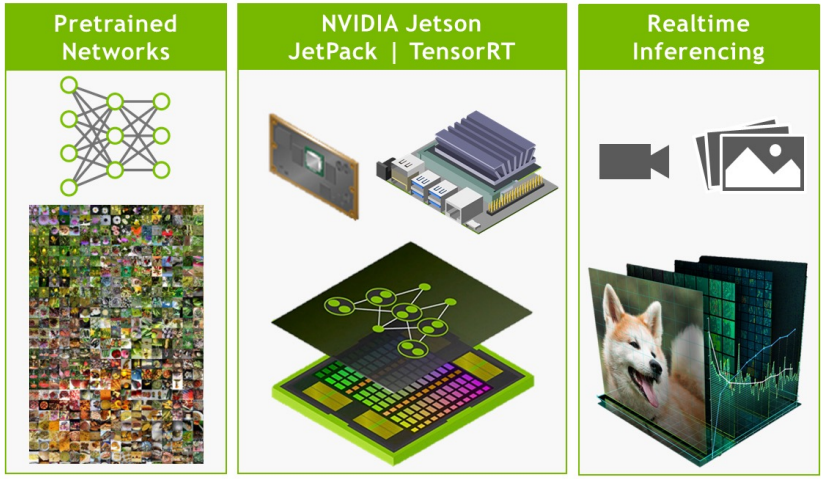
- Upgraded triple redundant IMU sensors for extra redundancy
- 2 sets of IMU are vibration-isolated mechanically, reducing the effect of frame vibration to state estimation
- IMUs are temperature-controlled by onboard heating resistors, allowing optimum working temperature of IMUs
- Integration of uAvonix ADS-B IN Receiver
- Built-In ADS-B Antenna

Machine Learning

Jetson TX2 features an



- Integrated 256-core NVIDIA Pascal GPU
- Hex-core ARMv8 64-bit CPU complex
- 8GB of LPDDR4 memory with a 128-bit interface
- 50 x 87 mm
- 85 grams
- 7.5 watts of typical energy usage



Today, thanks to the application of artificial intelligence and machine learning (ML), agriculture can count on a wider variety of data and analytics tools.
These data are provided by many different types of sensors that allow a better understanding of the environment (crops, weather conditions, soil ...) and the agricultural operations (machine data).
By feeding machine learning systems with the collected data, farm management can be supported with real-time recommendations elaborated via artificial intelligence

Future works

A battery swapping station, together with a battery charging station and wireless network, we would be able to program UAVs to conduct missions fully autonomously without sending pilots to fields particularly for changing batteries and downloading data

A UAVs swarm can be programmed to accomplish the same task increasing the area size under analysis, or performing different analysis on the same field equipping each UAV with different sensors