ROBSENSE
Humanise the Robotics

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ROBSENSE TECHNOLOGIES

RESEARCH LINE

2017

PRODUCT BROCHURE

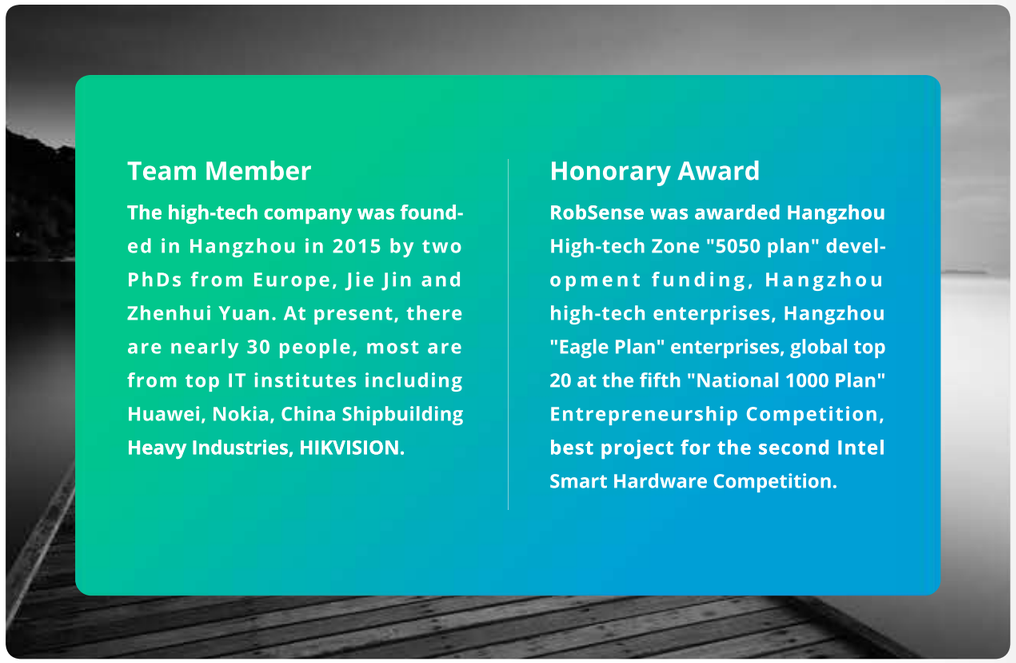
#FLIGHT AUTOPILOT #COMPUTER VISION #UAV OPERATING SYSTEM
#SENSOR FUSION #MACHINE LEARNING #SOFTWARE DEFINED RADIO
#LIDAR & MMWAVE RADAR #SWARMING

ABOUT ROBSENSE RESEARCH

RobSense Technologies is an innovator and producer of industrial unmanned systems. Benefit from the expertise of robotics and mobile networks, the company focuses on intelligent sensing and computing with advanced unmanned robots.

In 2016, RobSense released the world first all programmable SoC flight controller, Phenix Pro for micro UAVs. Phenix Pro makes UAV as “flying robot” and allows advanced AI algorithms running on board. RobSense owns a number of patents and innovative technologies in the field of both robotics control and mobile networks. To this day, RobSense has released SoC robotics controllers, UAV solutions and robotics communications subsystems for industrial IoT customers.

The RobSense Research Line fills the gap between academics and industry. The open-source flight controller and developer online community are used by top research institutes around the world. The UAVs - R450 and R650 - offer handy and relible flying platform for researchers with different backgrounds and help them to fast catch research opportunities.



Team Member

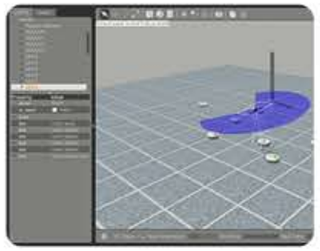
The high-tech company was founded in Hangzhou in 2015 by two PhDs from Europe, Jie Jin and Zhenhui Yuan. At present, there are nearly 30 people, most are from top IT institutes including Huawei, Nokia, China Shipbuilding Heavy Industries, HIKVISION.

Honorary Award

RobSense was awarded Hangzhou High-tech Zone "5050 plan" development funding, Hangzhou high-tech enterprises, Hangzhou "Eagle Plan" enterprises, global top 20 at the fifth "National 1000 Plan" Entrepreneurship Competition, best project for the second Intel Smart Hardware Competition.

RESEARCH AREAS

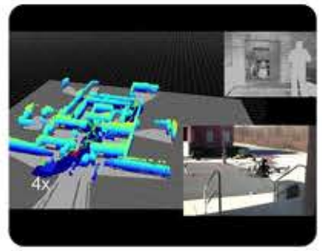
Shaping the Future of Unmanned Systems



Control Theory

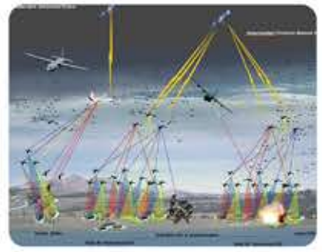
Embedded Vision/Deep Learning

5G/IoT



SLAM

3D Mapping



Swarm

ABOUT ROBSENSE

RESEARCH LINE

CONTENTS

DRONE R450/R650

The RobSense R450 and R650 are specifically designed for researchers who are fast prototyping novel ideas. Lightweight, foldable, robust frame with carbon fiber and simple structuer make the drone easy to maintenance.

R450 allows aggressive flight in narrow space, and by using multiples at the same time, swarm and coordination can be exlpored.
R650 is engineered for advanced automatic flight research projects. Besides the lightweight and robust structure, it allows more payload with more powerful sensing equipment.

Powered by RobSense Drone SENSE+ series - dual camera, mmWave Radar, LiDAR, swarm radio - R450/R650 is leveled up to enable cutting-edge experiments.

R450
Weight (battery & propellers included): 1.4kg
Diagonal Size: 450mm
Max Speed: 10m/s
Payload: 0.5kg
Max Flight Time: 15min
Max Wind Speed Resistance: 10m/s

R650
Weight (battery & propellers included): 2.6kg
Diagonal Size: 650mm
Max Speed: 15m/s
Payload: 1.1kg
Max Flight Time: 22min
Max Wind Speed Resistance: 10m/s

DRONE SENSE+

Dual Camera

8m range
720p MJPEG@30fps
USB2.0
Windows/Linux
30g weight
62mm two lens spacing
75mmx15mm

LiDAR

22m range
1cm accuracy
100kLux light intensity
0.6W power consumption
50g weight
62mmx39mmx26mm

mm Wave Radar

24GHz
1cm accuracy
30m range
0.8W power consumption
80g weight
85mmx55mmx18mm

Swarm Radio

400MHz/900MHz
LORA modulation
collision avoidance optimization
network diagnostic software
MAVLINK support
broadcast/multicast/relay

SOC ALL PROGRAMMABLE

FLIGHT CONTROLLER

Phenix Pro DevKit is the open-source version of RobSense Phenix Pro flight controller. DevKit is built on reconfigurable SoC and equipped with real time operating system. The flight platform supports 20+ interfaces including on-board sensors, mmWave radar, LiDAR, thermal camera, ultravision HD video tranceiver, etc.

ALL PROGRAMMABLE

Based on Xilinx Zynq SoC. Phenix Pro DevKit makes UAV as “flying robot”. Dual core ARM+FPGA allow advanced AI algorithms running on board, leading to 100x higher performance than GPU. Phenix Pro DevKit supports intelligent environment sensing, obstacle avoidance and autopilot.

UAV OPERATING SYSTEM

Designed as next generation flight control system, Phenix Pro DevKit has built in multi-task scheduling for intelligent algorithms and hardware resource management. PhenOS enriches user experience with high stability and maneuverability by supporting real-time data fusion and attitude estimation.

DEVELOPER COMMUNITY

RobSense is running a global online community for worldwide drone and robotics developers. Wikipedia-flavour development guide is available to offer up-to-date scientific progress from variable research groups.

HIGHLY EXTENSIBLE

Phenix Pro DevKit supports most on-the-shelf sensors, including IMU, GPS, camera, lidar, and etc. With CAN bus, DevKit allows multi-access of 20+ different sensors and devices.

REDUNDANT & DATA FUSION

Data obtained with multiple IMUs is analyzed in real-time using intelligent data fusion technology, which minimizes system errors and enhances safety. With redundant design, reliability of the flight controller can be ensured even in worst case, i.e. two IMUs crash. Redun dant design based on three GNSS sets protects UAVs against complex and volatile industry situations.

AVIONICS SAFETY

In-chip memory protection mechanism isolates core flight control algorithm within protected memory space. Flight control is extremely robust without infection from system error propagation. In-chip random error detection and correction algorithm recovers rare memory errors in time to ensure reliable flight control.

WHAT WE PROVIDE

On Board Computer

SOC	Xilinx Zynq 7020
OS	PhenOS(RTOS),ROS
CPU	Dual Core ARM,PX4
FPGA	Artix-7
Flash	32MB
DDR3	512MB
TF Card	16GB

Reserved Interfaces

Accelerometer (SPI)	×1
Gyroscope (SPI)	×1
Compass 1 (SPI)	×1
Barometer (SPI)	×1
Telemetry (UART)	×1
GPS (UART)	×1
Compass 2 (IIC)	×1
SBUS (UART)	×1
PWM (GPIO)	×8
JTAG (PS/PL)	×1

Extended Interfaces

USB2.0	×1
UART	×3
IIC	×1
CAN	×1
SPI	×1
miniHDMI	×1
Camera Link	×1
LVDS	×1

WHAT YOU CAN BUILD

Sensor Fusion

IMU (I3G4250D+IIS328D+LIS3MDL)
GPS (UBLOX-M8Q)
Barometer (MS5611)
Optical Flow
Ultrasonic
Lider
MmWave Rader

Control Theory

Extended Kalman Filter
Adaptive PID
LQR Control
Sliding Mode Control

Computer Vision

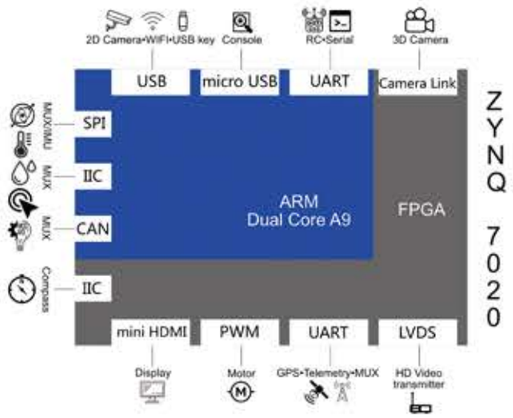
Image Processing
Feature Matching
Object Analyzing

Machine Learning

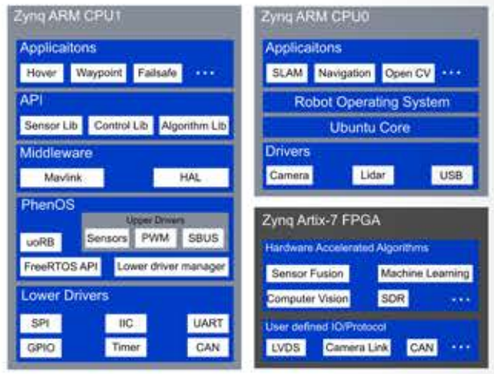
Deep Learning
Reinforcement Learning
Deep Neural Network
Recurrent Neural Network
Convolutional Neural Network

Software Defined Radio

4K Video Transceining
Fast Prototyping of 5G
Wireless Channel Security



Hardware Architecture



Software Framework

PHENIX PRO DEVKIT SPECS

GENERAL

Size:	FCU:73.8mm*55.8mm*18mm
	HUB:55mm*30mm*11.9mm
	IMU:46.5mm*46.5mm*14.5mm
	LED:32mm*32mm*8mm
	GPS:60mm*60mm*15.6mm
Supported Multi-rotor:	Quadcopter:I4、X4
	Hexacopter:I6、X6、Y6、IY6
	Octocopter:X8、I8、V8
Supported ESC:	400Hz frequency
Recommended Battery:	3s to12S LiPo
Recommended Radio:	SBUS PPM and PWM
Operating Temperature:	-40°C to+85°C
Vibration Damper:	<3g
Built-in Function:	Stable mode
	GPS mode
	Waypoint flight mode
	Click and fly mode
	Geo-fence
	Failsafe mode
	Low voltage protection

FLIGHT PERFORMANCE

Max Tilt Angle:	35°
Max Yaw Angular Velocity:	150 deg/s
Max Vertical speed:	6m/s
Hovering Accuracy:	Horizontal ±1.5m
	Vertical ±0.8m

PROTECTION

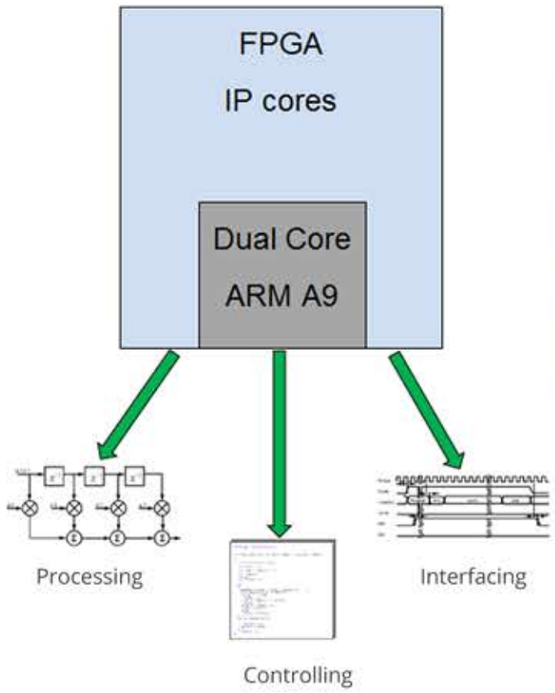
Motor Fail Protection:	Hexacopter/Octocopter
Low Battery Level Warning:	Smart RTH or Landing
Low Battery Voltage Warning:	Smart RTH or Landing

DEVELOPMENT TOOLS

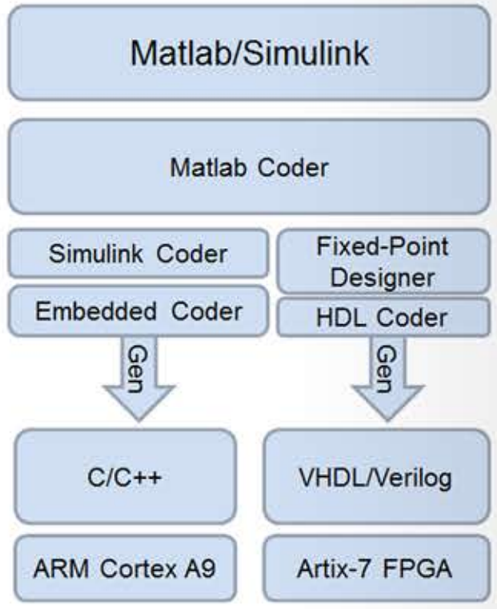
The basic idea of the Phenix Pro DevKit is to use System on Chip with three processors: two ARMs and FPGA. While ARMs deals with flight controlling, task scheduling, hardware communications and data fusion loop, FPGA is reserved for user's free development.

With the benefits of Matlab Simulink, the widely used modelling software, DevKit offers simulink toolkit to include several pre-defined flight controlling models.

By using advanced compilers, e.g. embedded coder and HDL coder (XiLinx), the model can be automatically translated into C/C++ and VHDL code or binary code that are directly implemented on DevKit hardware processors.



MathWorks
Linux Embedded
GNU ARM
VIVADO



R&D Projects Participation

NSFC, DroneSwarm, "Software Defined Routing for Swarm of Drones", #61601159, 2017-2020.

EU H2020, INPUT, "In-Network Programmability for next-generation personal cloUd service supporT", #644672, 2015-2018.

IEEE Communications Magazine, ComProSe, "Shaping Future Public Safety Communities with ProSe-based UAVs", research collaboration with Huawei at 3GPP, DCU at Ireland, HDU at China, 2017.

NSFC National Natural Science Foundation of China
3GPP A GLOBAL INITIATIVE
HUAWEI
HANGZHOU DIANZI UNIVERSITY
DCU

DEV COMMUNITY

http://dev.robsense.com

"RobSense is running an online community for global developers and researchers, to brainstorm more exciting technologies based on UAVs. Our research team has deep collaborations with top institutes and labs worldwide doing research including computer vision, deep learning, software defined radio, 5G and control theory."

-Dr.Zhenhui Yuan

Chief Scientist & Co-Founder@RobSense

Flight Control Stack

where you can make the "cerebella" of your flying robot. Redundant IMU design & data fusion technologies minimize system errors and enhance flight safety.

Deep Learning

building the "neural"system of your robot and making it better understand the physical world. The FPGA-based architecture offers powerful computing capability and helps to realize your research.

Computer Vision

building the powerful '"eyes" for your own robots. RobSense flight controller enables flying your computer vision algorithms.

UAV Operating System

acting as the "brain" of your flying robot. The embedded operating system enables built-in multi-task scheduling for intelligent algorithms and hardware resource management.

Hardware

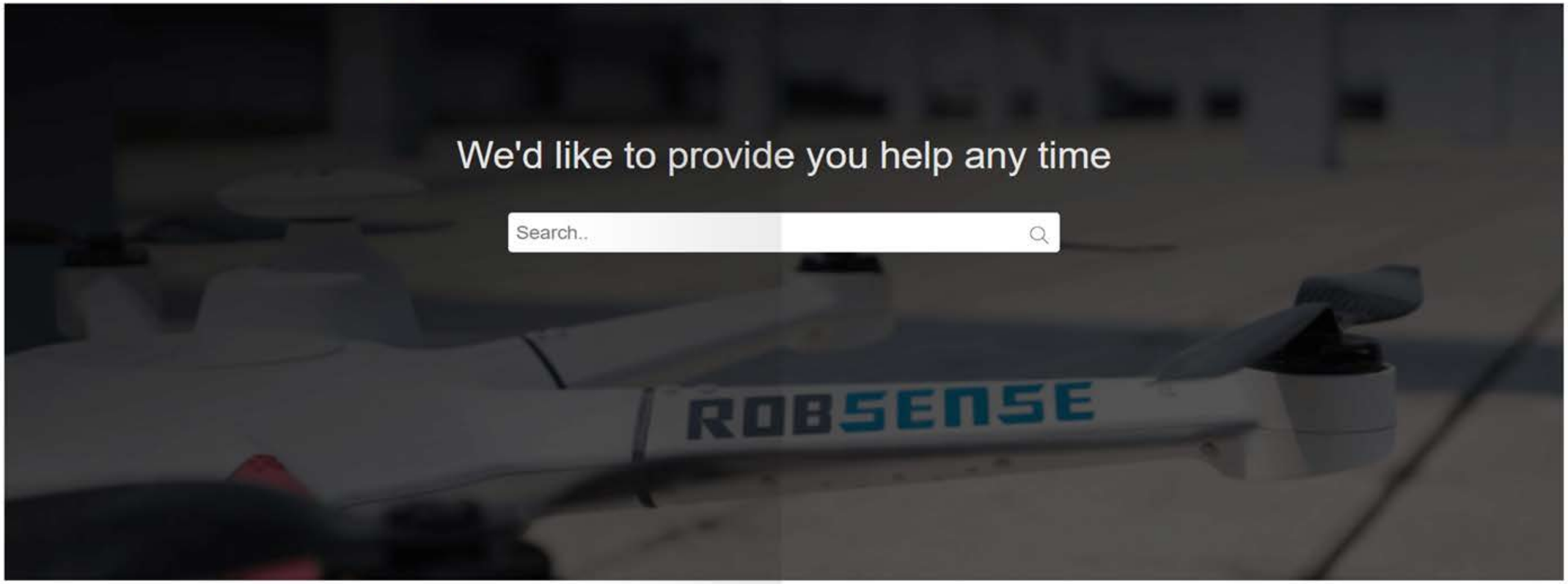
being the "skeleton" of robot. ARM+FPGA allow advanced AI algorithms running on board, leading to 100x higher performance than GPU.

Communications

prototyping your state-of-the-art research such as SDR-based wireless video communications, ultra-long distance radio station, UAV swarm networking, mmWave, Backhaul, etc.

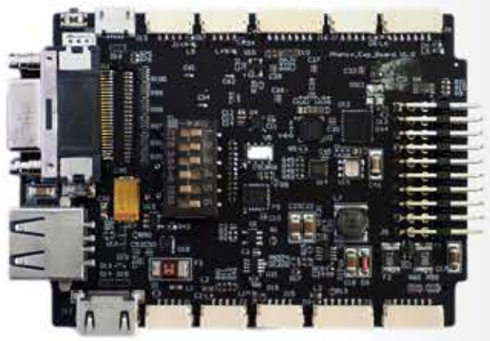
ROBSENSE

Home | Phenix Pro | Phenix Lite | Support



GITBOOK

http://guide.robsense.com



We use GitBook to help developers write,collaborate and publish content online. Code and examples are located at open-source platform GitHub which seamless supports GitBook. Our idea is to remove distractions and concerns from content creators and make writing freely.

The PhenixPro Flight Controller DevKit

1. The codebase is host on github: https://github.com/RobSenseTech/PhenixPro_Devkit.git.
2. The developers' guide is available at: https://guide.robsense.com/.
3. Developers can push questions to the user forum at: http://dev.robsense.com.

SERVICE /// SUPPORT

Development

Development with unmanned systems like UAVs involves many challenges due to the cross-field scientific knowledge. Our field area engineers are happy to provide you with technical services. Frequently asked questions might be answered at our development community: http://dev.robsense.com.

Ordering & Shipping

For any enquiries about the purchase, please feel free to contact us by sales@robsense.com. We will prepare an optimal offer according to your object and purpose. Delivery times depend on the type and scope of your order. Our sales team will process your order as quickly as possible.

Research Collaboration

We are always open and excited to collaborate with worldwide research institutes. We would be happy to provide tailored hardware and software unmanned system for challenging projects including computer vision, deep learning, automatic control theory, swarming, etc.

PRODUCT OVERVIEW

Product	Basic Description	
Phenix Pro Devkit	Xilinx ZYNQ 7020, Dual Core ARM A9+FPGA, RTOS, ROS, PhenOS	
R450	450mm, 1.4kg weight, 0.5kg payload, 15min flight time	
R650	650mm, 2.6kg weight, 1.1kg payload, 22min flight time	
Drone SENSE+	Dual Camera	8m range, 720p MJPEG, 30g weight
	LiDAR	22m range, 1cm accuracy, 50g weight
	mmDAR	24GHz frequency, 30m range, 1cm accuracy 80g weight
	Swarm Radio	400MHz/900MHz, LORA, collision avoidance, MAVLINK