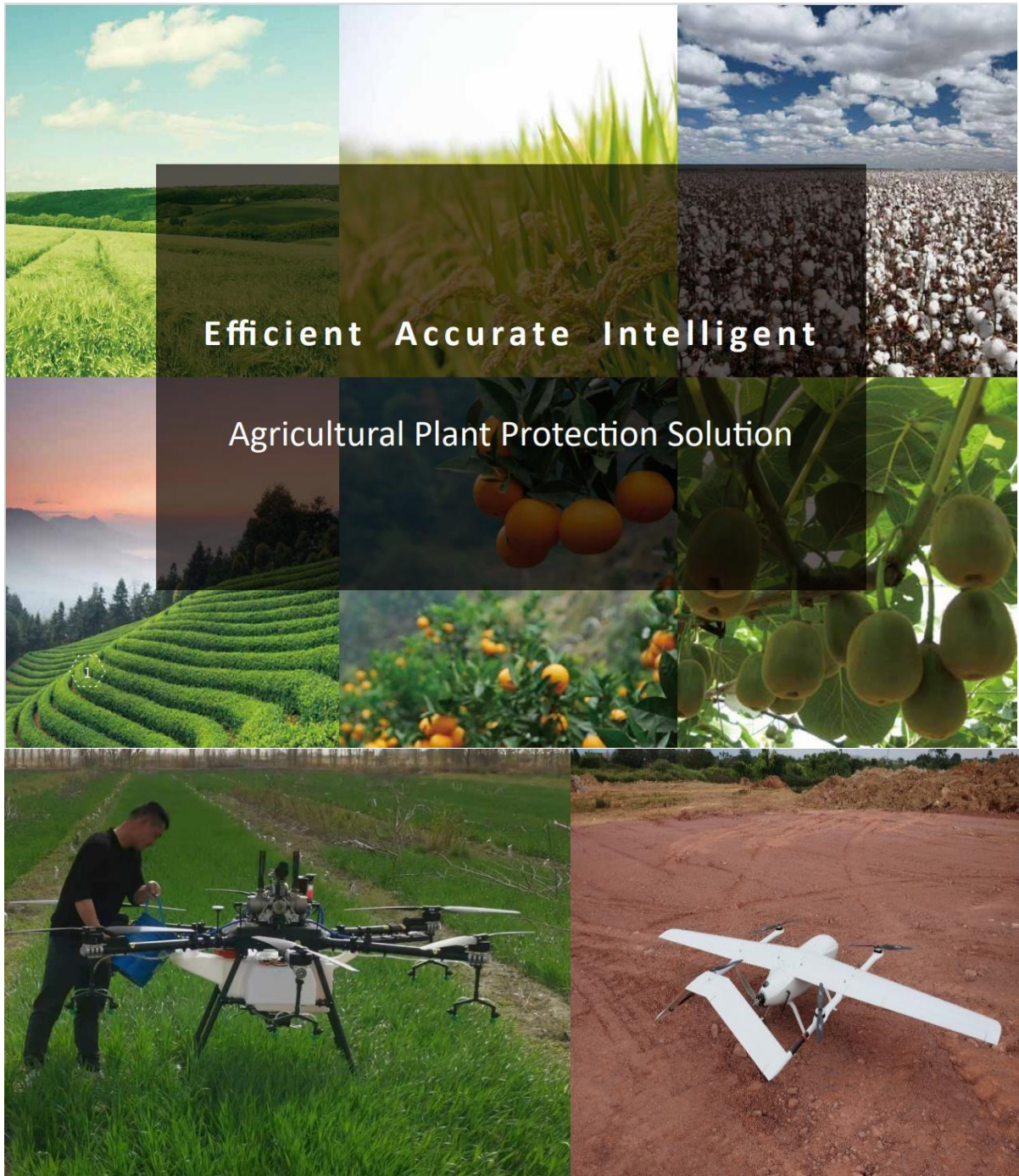




# Large Capacity Spraying Drone





## Company introduction

In January 2014, our company C h a n g f e n g was committed to becoming the world's leading supplier of industrial-grade UAV system application solutions. We continue to innovate around the needs of customers, and UAV products based on high-performance control systems are widely used in military and civilian fields.

The world's first fuel-driven direct-drive multi-rotor UAV independently developed by the company, as a leading research result, was invited to participate in the 2016 National "Twelfth Five-Year" Science and Technology Innovation Achievement Exhibition.

The company has successively won the third place in the 2015 First Innovation and Entrepreneurship Competition and Maker Competition, The First place of 2016 Dark Horse Entrepreneurship Competition in Shenzhen Division, the 2016 Chengdu Jingronghui "Most Investment Value Award", the 2016 China Innovation and Entrepreneurship Competition Robot Maker Competition, the second place in the country, the 2017 Innovation List, the most potential project and other honors.







## Certification

- National High-Tech Enterprise
- GB/T29490-2013 "Intellectual Property Management System Certification Certificate" ISO 9001:2015 "Quality Management System Certification Certificate"
- "Civil Unmanned Aircraft System Pilot Training Organization"
- "Civil Unmanned Aircraft Operation Permit"

## Social duties

- Director Unit of Shenzhen UAV Industry Association
- Vice-chairman unit of "Agricultural Development and Equipment"
- magazine under the charge of the Ministry of Agriculture
- Founding member of Shenzhen Youth CEO





## User cases:

### Part customers of Domestic

- PetroChina Eastern Geophysical Prospecting
- Hefei Institute of Optics and Mechanics
- 207 Institute of Aerospace Science and Technology
- Shijiazhuang Tiansheng Arms Factory
- Shanghai State-owned Assets Supervision and Administration Commission Shangshi Agricultural Group
- Changqing Oilfield Petroleum Pipeline Inspection
- Shanxi Diop Technology Aviation Surveying and Mapping

### Part customer of Foreign

- Marussa Corporation, Japan
- Japan Ecocoku Co., Ltd.
- New Zealand evcotech
- Poland
- German Siemens engineer
- Dubai



FIGURE 0-1 AGENCY SALES CHANNELS COVER 12 DOMESTIC PROVINCES AND CITIES AND 4 FOREIGN COUNTRIES



# Introduction of Agricultural Spray drone



FIGURE 0-1 HYBRID LARGE CAPACITY SPRAY DRONE

## ○ Introduction

The oil-moving plant protection drone is a hexa-copter equipped foldable propeller with an intelligent spraying system. It adopts RTK positioning technology, dual antenna direction finding technology, and centimeter-level radar height measurement technology. It has the characteristics of large load capacity, accurate spraying, high positioning accuracy, anti-geomagnetic interference, terrain like flight and fully autonomous operation, etc., which can greatly improve operating efficiency, and reduce operating costs.

## ○ Characteristics

### 1. Super load, long battery life

The fuselage structure composed of carbon fiber and aviation aluminum alloy reduces the weight of the fuselage while ensuring the strength and rigidity. Equipped with six internal combustion engines to provide strong power.

### 2. Efficient operation

Use 92# gasoline as fuel, which is convenient to add and guarantee long-term uninterrupted operation. A reference station can control multiple UAVs at the same time, effectively reducing personnel costs and improving operational efficiency. Each machine can operates 2~4 mu per minute, upto 2000 mu (130 hectare) in a single day.

### 3. Intelligent autonomous flight controller

Equipped with the self-developed second-generation CAPTAIN flight controller, using advanced control algorithms and navigation algorithms, with centimeter-level precise positioning of the RTK reference station. According to the pre-surveyed route and set flight parameters, one-key takeoff can realize the whole autonomous flight without joystick operation. Combining the flight altitude, speed and spray width data to intelligently plan the route, so as not to miss or re-spray. Equipped with a radar height-fixing module, the



accuracy is up to centimeter level, it can scan the terrain in real time, automatically maintain the distance between the crops, and ensure the uniform spraying effect.

## 1.2 Technical Data

**TABLE 1 HEAVY LOAD DRONE SPECIFICATION**

UAV type	Hybrid of Gasoline and Electrical Li-Po Hexa-copter
Material	Composite carbon fiber material
Propeller type	Carbon fiber foldable propeller
Camera	FPV camera
Night operation	LED light
Plastic tanker load	85L
Flight range	75 km
Flight Duration	75 min with payload
Power distribution	On-flight charging with redundant battery and smart power management
Max flying altitude	3000m ASL
Maximum Flight speed	20m/s
Flight operational speed	12m/s
Wind resistance	Level 7
IP protection	IP54
Autopilot IP protection	IP66
Hovering accuracy	$\pm 0.1\text{m}$
Engine fuel capacity	4L
Reliability	Return to home, return to launching site, real-time battery status, and automatic landing, LED lighting
Spray pump valve	3 valves Integrated with flowmeter 1 valve for 2 nozzles
Sprayer nozzle	Efficient atomizer type nozzle
Spray nozzle controller	Adjustable nozzle controller
Droplet size	40-100 microns of droplet
Sprayer application rate (VAR)	3-to-7 Liter per Acre
Spray width	10–12-meter uniform spraying
Spray agent	Water based, ULV



## Large Capacity Long Endurance

The combination of carbon fiber and aviation aluminum alloy fuselage structure ensures the strength and rigidity while reducing the weight of the fuselage. Equipped with six internal combustion engines to provide strong power. Maximum load up to 70 kg, maximum endurance up to 3 hours.

\*The load and endurance data are obtained from the test below 100m altitude.

## ○ Flight control system

### 1.1 Introduction

The flight control system is suitable for the professional plant protection control system of oilpowered multi-rotor and electric multi-rotor. It widely supports quad-rotor, hexa-rotor, octorotor and other multi-rotor drones. It adopts RTK positioning technology, dual-antenna direction finding technology, and centimeter-level radar height measurement technology. It has the characteristics of accurate spraying, high positioning accuracy, anti-geomagnetic interference, terrain-like flight and fully autonomous operation, which can greatly improve operating efficiency and reduce operating costs.



### FIGURE 0-2 CAPITAINE FLIGHT CONTROLLER

## 1.2 Technical data

TABLE 2 FLIGHT CONTROLLER SPECIFICATION

Positioning technology	RTK system
Sensors	Redundant IMU sensors (Accelerometer, gyroscope, compass, magnetometer, barometer)
GNSS support	Baidu, GPS, GLONASS
RTK data update frequency	10HZ
Dual antenna direction finding update frequency	20HZ
RTK positioning accuracy	1CM
Double antenna direction finding accuracy	Course 0.2°/1M
Magnetic sensor range	±8GAUSS
Ground radar accuracy	0.05M
Radar ranging range	0~10M
Three-axis acceleration range	±16G
Hover accuracy	± 0.1M





Terrain slope	< 20°
Hot start time	< 15S
External data link	840MHZ/2.4GHZ 0.5W~1W optional
Interface Type	Support CAN, UART and other
Voltage input range	3S~12S
Support receiver type	S.BUS/PWM
Working temperature	-20°C~70°C
Other Features	Power-off mode, stand-by mode, ground-error mode, loiter mode, altitude-hold mode, stabilize mode, automatic landing mode, break-point return mode, return to launch mode, on-flight mission planning, plug and play, reverse polarity and over-voltage protection,
Enclosure	Rigid protective enclosure

### 1.3 Hardware specifications

Flight control module	55.1MM*40.2MM*16.9MM
SENSOR HUB	78.0MM*52.2MM*16.9MM
RTK (Dual Antenna Direction Finding)	104.1MM*64.1MM*20.7MM
RTK antenna	29.8MM*29.8MM*56.3MM
Power Indicator	30.1MM*30.1MM*11.2MM
Radar module	51.6MM*35.9MM*48.9MM
DATA-LINK	56.0MM*31.5MM*16.0MM
RTK-RADIO	55.1MM*40.0MM*13.0MM
CF-SPARY	120.8MM*70.0MM*23.2MM
RTK base station (without tripod)	87.0MM*87.0MM*995.0MM
RTK surveying station (without handheld pole)	87.0MM*87.0MM*963.0MM



## 1.4 Characteristics

### Stable flight, safe and reliable

Advanced algorithm oil-electric dual control, The CAPTAIN V1 flight control system uses advanced navigation control algorithms, which are deeply optimized for the characteristics of oil-powered multi-rotors, and are suitable for oil-powered multi-rotors and electric multi-rotors. The optimized internal shock absorption and the new fusion algorithm greatly reduce the impact of body vibration on the IMU. The built-in high-performance dual redundancy IMU can realize real-time mutual backup of data, combined with the new internal shock absorption structure design, to give the aircraft higher reliability and ensure the safety and stability of the flight.

### RTK positioning centimeter error

The self-developed HPPS-1 high-precision positioning system adopts carrier phase difference technology, also known as RTK (Real-time kinematic) technology, and has an advanced dual-star solution engine to realize GPS+BDS dual-star solution. HPPS-1 is not restricted by visibility conditions and has a coverage radius of 5KM. It can provide centimeter-level positioning information in real time, providing a strong guarantee for high-precision measurement of plots and high-precision positioning and flight of UAVs.



FIGURE 0-3 DUAL ANTENNA RTK

### Radar altitude measurement

Equipped with high-precision radar sensors, centimeter-level ranging accuracy, the height measurement range is 0~10m, which can meet the operational needs of different crops. The terrain can be scanned in real time, and the flight height can be adjusted in time according to the terrain and crop height to achieve terrain-like flight, ensuring uniform spraying effects and adapting to the operational needs of different terrains.



## Chihiro location precise service

Use Qianxun's precise positioning service to provide reference information for UAV flight and plot measurement to achieve high-precision positioning.



## Dual antenna direction finding Anti-magnetic interference

Equipped with dual-antenna direction-finding technology, the carrier signal is used to accurately measure the flight heading of the UAV, solving the problem of strong magnetic interference, and ensuring that the UAV can fly normally under strong magnetic interference environments such as high-voltage lines, mining areas, and mountainous areas. During the flight, the route deviation can be repaired in real time to ensure that the UAV can fly according to the planned route.

## Plan obstacle avoidance to reduce risk

The HPPS-1 surveying and mapping station can directly mark obstacles or obstacle areas, and the UAV will automatically bypass the obstacle areas and continue operations during flight operations. While ensuring flight safety, it will ensure that flight operations will not be interrupted, improve operation efficiency, and reduce the risk of bombing.

## Intelligent early warning, out of control protection

Equipped with a complete protection mechanism, real-time monitoring of flight status, APP will automatically remind and return to home when the signal is weak or faulty, and automatically return to home when the fuel is low or low voltage.



Convenient operation and efficient collaboration Simple setting and convenient management

Equipped with a dedicated land surveying and mapping APP, you can complete work order management, land surveying and mapping, and obstacle area labeling with simple operations.

One-key take-off and landing autonomous flight

Equipped with a dedicated flight operation APP, which can automatically generate flight routes by directly setting flight operation parameters, and edit and modify flight trajectories. The flight route planning is flexible and the operation control is convenient. One-button take-off and landing, full autonomous flight operation, avoiding losses caused by human operation errors. The App which can be reconfigured also supports intelligent agriculture with selective spraying from surveyed area.



FIGURE 0-4 INTEGRATING MOBILE WITH THE SYSTEM





## Collaborative work is fast and efficient

A reference station can be used for collaborative operation of multiple drones, efficiently manage drones and related equipment, realize the efficient operation of teams and equipment, greatly improve operation efficiency and reduce equipment costs.

## One-click synchronization Cloud storage

All surveying and mapping information and operation parameters are automatically synchronized and stored in the cloud. When you work again, you only need to synchronize the data and you can work without repeating surveying and setting.



**FIGURE 0-5 HEAVY LOAD DRONE DURING SPRAYING**

## Intelligent planning and precise spraying Data linkage, precision and intelligence

Precise intelligent spraying control, horizontal movement to stop spraying, equipped with a flow sensor to monitor the spraying flow in real time. The spraying system matches the flight speed to achieve a constant dosage of medicament per acre, ensuring that the crops can be sprayed evenly, so that no respray and no leakage Spray, greatly improve the utilization rate of the agent with selective spraying features.

## Resume after stopping medicine

Equipped with level gauges, flow meters, and hydraulic sensors, real-time monitoring of the remaining amount of medicament, and automatic return to flight if the medicament is stopped. The spraying information is recorded in real time, and the spraying operation is automatically continued at the break point after adding the medicine, so as to realize the seamless break point and continuous spraying.

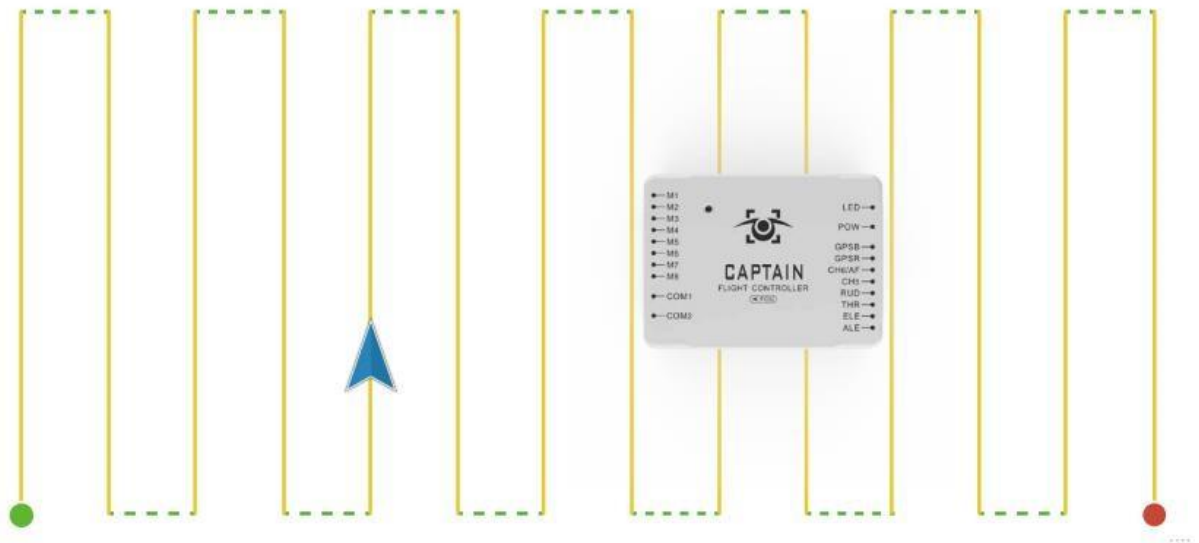


FIGURE 0-6 GCS SHOWING SPRAYING MISSION PLAN DIRECTION

## Cloud Intelligent Management Big Data Service Real-time monitoring and flexible deployment

A complete management platform not only helps users understand the status of the aircraft in real time, but also allows team managers to view the progress of operations in the plant protection area, the results of operations, and the distribution of drone equipment in real time. According to demand forecasts, personnel and equipment are dispatched in real time, which greatly improves team work efficiency.

### Ground Control

The GCS3 and DL2 datalink and RC system allows us to have real-time telemetry data and secured radio control.

TABLE 3 GCS3 GROUND CONTROL

Datalink	Redundant 75 km LOS communication
RC controller	3KM range 12 VDC channels Realtime stable video link from 2km
Secured communication channel	FHSS and DSSS, AES
Operating system	Windows/Android/IOS
Number of drone control	5 drone in a single ground station
Positioning technology	Integrated RTK



## Multi-source data Multi-level management

Through the collection of diversified data and multiple types of data (measurement data, data generated by drone flight operations, artificially added data during operations, business activity data, etc.), a multi-dimensional analysis chart is constructed to help managers count data, analyze development trends and formulate deployment plans. Multi-level management mechanism can give different levels of managers different management permissions to ensure data isolation and security



FIGURE 0-7 GCS APPLICATION COMPUTER

Website: <http://www.cfuas.com/#>