

Near-surface Rapid Rescue and Supervision Platform

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Abstract

In China, the number of drowning deaths is increasing year by year, water surface safety has become a troubling problem that cannot be ignored. The new surface high speed rescue supervision vehicle platform is called ground effect vehicle for short. The product is mainly used in inland lakes, rivers and other water areas of drowning rescue and real-time danger monitoring. Ground effect aircraft has the advantages of fast rescue speed, high safety, easy to learn and easy to carry, and can greatly improve the rescue speed and accuracy with other surface rescue tools, which is conducive to maintaining surface safety.

Keywords

Ground Effect; Aircraft; Rescue.

1. Introduction

The product developed by our team is named: New Surface High Speed Rescue Supervision Aircraft Platform (see figure), short for ground effect aircraft. The product is mainly used in inland lakes, rivers and other water areas of drowning rescue and real-time danger monitoring, it is mainly used in east and South China water entertainment venues and well-known civilian rescue teams. The product application scope is broad, big market, strong practicability, and the price is low, the product is used in ground effect principle, overcome the performance disadvantage of traditional products, and USES the high-tech 3 d printing design, high integration, small volume, stable performance, compared with the current market similar products, the technology has been in the leading domestic and international advanced level, with complete intellectual property rights. The model of the product is shown in Fig 1.

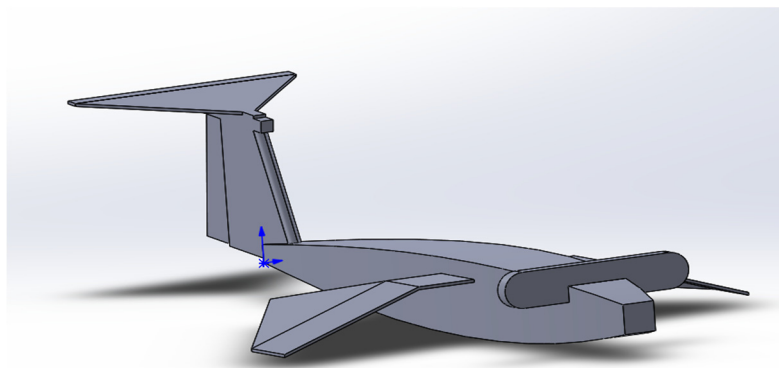


Fig 1. The model of Ground effect aircraft

Since the operation mode is to cooperate with rescue boats to play a pioneering role, it will form a succeeded-after rescue relationship with them. Our main competitors are not rescue boats but

rescue auxiliary equipment, and because of our extremely fast surface speed, we have considerable advantages and competitiveness.

2. Project Background

Every year, tens of thousands of people die from drowning in our country, and the issue of water safety haunts our people.

We investigated the increasing financial losses and related legal issues caused by drowning among our clients:

(1) The significant characteristics of drowning process are: the time to wait for rescue is very short. In view of this feature, the speed of most rescue methods is not fast enough, the golden time of saving people is 2 to 3 minutes and in 5 to 6 minutes, due to the lack of oxygen and irreversible damage to human organs. The existing rescue methods for drowning people are mainly artificial rescue or throwing life-buoy and other rescue materials. But the problems with this method are obvious: for one thing, there is often a lack of skilled rescuers around the drowning person, or it is difficult for rescuers to arrive in time. Second, even if there are rescue workers next to, after falling into the water, drowning people will hold onto the object beside them, we think that the life buoy can play a rescue effect. Therefore, we need a tool that can find and carry swimming rings to drowning people in the golden time.

Our ground effect vehicle, which can travel at least 60km/h over the water, is a perfect solution to this problem.

(2) Fixed-point delivery of relief supplies is an important method to prolong the waiting time for rescue of drowning people and improve the survival rate of drowning people and rescuers. But the current use of throwing and other methods such as rescue materials such as life buoy, there are short throwing distance, materials are difficult to accurately put into the drowning side and other problems.

The special airfoil used in the ground effect vehicle designed by us can solve the problem of load and fixed-point delivery, and can adapt to the application site.

From the above research results, we can see that the drowning problem in today's society cannot be ignored, and the government and relevant enterprises have invested a lot of manpower and material resources, hoping to improve the drowning problem, and the growing investment indicates that the market has great potential. There is a growing need for devices that can monitor water conditions in real time, spot drowning victims and deliver aid.

In view of the applicability characteristics of the product, we have concluded that the product customers can be divided into two categories: self-employed and water rescue teams. We find in the related products, in the related website platform and in the paper, which does not appear similar products, and in the main rescue vessels, aircraft we just play a vanguard role, the need to form a courageously and lifeboat rescue relations, there is no substantial competition but complementary and enable it to better complete the rescue mission.

Therefore, in the field, there are few competitive products for our rescue ground effect aircraft among the related products we find, which belongs to the basic blank large-scale market and has a strong development scale and potential.

Ground effect aircraft main characteristic is immediate, it is also the future trend in this field, in the direction of the production of concise rescue rapidly development, our equipment can not only in the guarantee for the security of the people on the water, provide convenience for the rescue, at the same time, to let the aid workers proper rest, save human resources and material resources. If the service has a certain market, it can reflect the corresponding demand. In order to further adapt to the market demand, expand the market scale, so as to meet people's demand for a better life.

3. Product Introduction

3.1. Rationale (Ground Effect)

Ground effect, also known as wing-in-ground effect or wing-in-surface-effect, refers to the aerodynamic interference generated by the Ground when the moving object runs close to the Ground. When an aircraft is flying or operating close to the ground, the ground affects the flow characteristics of air around the aircraft. Ground effects can occur in low-flying aircraft or helicopters, as well as in automobiles and motor boats.

It is a kind of fluid mechanics effect that can reduce the induced resistance of aircraft and obtain a higher lift-resistance ratio than air flight: when the moving aircraft falls close to the ground (or water), the pressure difference between the upper and lower of the whole aircraft body increases, and the lift force will increase sharply.

3.2. Product Features

Due to ground effect craft for speed threshold, the flight has high requirements, such as, we use the front two motor in the low-speed cases can also have a certain effect on the ground, use independent tuning of the flight control system with parameter to control the plane near surface profile to the wind, using gyroscope, speed meter to optimize the stability of the aircraft, using large flaps and delta wing control logic, to achieve a smooth flight condition. Considering the danger of the accident, we use a high speed and small torque motor for braking, so that it can have a bigger start acceleration, faster rescue.

At the same time, we have the power group and structure optimization, on the power, our battery efficiency is much higher than rescue machine rotor type, on the structure, because it is near surface relief and writes a close, we adopted the double plate processing mode, the wing drowned man pressure is easy to fall off, and the body will not sink water, while protect swimmers from secondary injury, perfect the structure, Make the wings replaceable for easy maintenance and rescue.

3.3. Product Advantages

3.3.1. Comparison with Existing Products in the Market

Ground effect aircraft have lower production costs compared to other water rescue equipment. Its rescue speed can reach about 70 to 80km/h. The comparison of ground effect aircraft and other water rescue equipment with rubber boats is shown in the following Table 1.

Table 1. Comparison of rescue products

Product	rubber dinghy1	rubber dinghy2	Earth effect vehicle	Quick rescue boat
Speed (km/s)	10-15	10-15	75-100	60-90
Cost (YUAN)	2600	500	1000	20000-50000
Operator number	2-4	2-4	1	4

In order to compare the advantages of ground effect aircraft, a bar chart is established as shown in Fig 2.

In addition, the ground effect aircraft has excellent wind resistance performance and can be competent for a variety of weather. The comparison of its stability with other products is shown in the following Table 2.

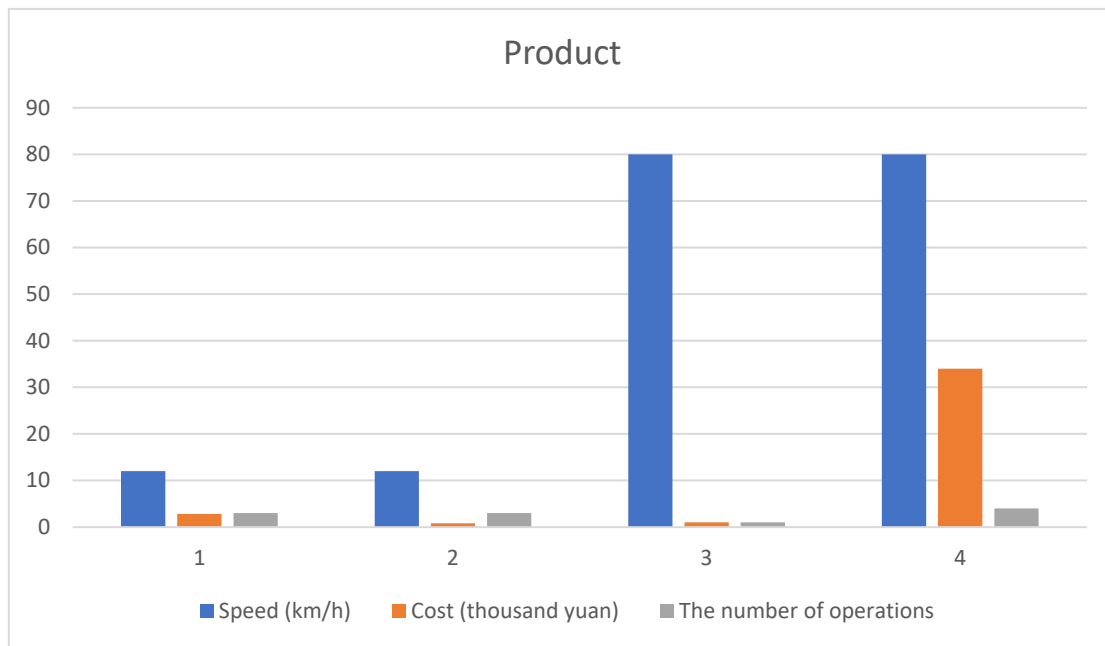


Fig 2. Comparison of rescue products

Table 2. Comparison of stability

Product	Rubber boat 1	Rubber boat 2	Ground effect aircraft	Quick rescue boat
Application scenarios	Waters with fast currents	Waters with fast currents	Waters with slower currents	Basically all waters
The wind speed (Lower than level 8)	Basically no impact	Basically no impact	Below the level 5	Basically no impact

The energy efficiency of ground-effect vehicles is also excellent, as shown in the Table 3.

Table 3. Comparison of efficiency

Product	Quick rescue boat	Four-axis uav	Ground effect aircraft
Energy efficiency (Kinetic energy ratio)	25%-30%	40-45%	75%-80%

In the design process, we use recyclable PP materials, with considerable strength and light weight at the same time, has the advantages of green environmental protection, in line with the current design concept. At the same time, the structure is simple and durable, providing advantages for maintenance and mass production. The aircraft should have peripherals capable of carrying GPS positioning, route planning and cruise.

It can be seen that the product has good speed and low cost, can cooperate with the rescue team to carry out rescue quickly, can provide good rescue services and user experience, make rescue safer and more reliable.

3.3.2. Rainfall Distribution on 10-12 Innovations

It has a small thrust-weight ratio and a high efficiency power system, and uses the airflow brought by the blades to improve the operation efficiency. In the process of driving on the water surface, a new design is adopted, which uses water resistance to lift the pitch Angle, so that it

has two characteristics of fast start on the water surface and large load capacity, and the two designs are reported to the Patent Office.

3.3.3. Product Features

(1) Portable and fast

The lightweight craft allows a single rescuer to deliver the aid precisely to the drowning victim, buying time for subsequent rescues. The aircraft flies very fast over water, covering a distance of 50 meters in only 1.86 seconds. Once rescue workers arrive at the scene, they can quickly drop aid to the drowning victims

(2) High security

In the design of the aircraft, the position of the paddle is designed to be high from the water, which does not pose a threat to the people in danger. At the same time, the aircraft material is relatively soft, ensuring the safety of the product.

(3) Simple and easy to learn

The ground-effect vehicle can float on water and fly quickly again when the throttle is turned on. Our design ensures that customers can use the aircraft to carry out rescue after a short training after purchasing the product.

3.3.4. Market Matching

In view of the existing drowning accident rescue existence: 1, the uncertainty of rescuers, rescuers are not defined as professional rescuers, which may cause secondary injury to drowning personnel; 2. Time difference between traditional monitoring equipment and rescue personnel; 3. Rescue equipment is cumbersome and not convenient enough... The ground-effect aircraft designed by our team has real-time cruise and rescue functions. Through relevant programming, the ground effect aircraft controlled by predetermined program can achieve cruise in inland lakes, reservoirs, rivers and other water areas; When the face recognition system monitoring by drowning personnel, the aircraft will be through the predetermined procedures of the surrounding nearest relevant departments to send an alert at the same time to the drowning area; When the system detects that the distance between the aircraft and the drowning person reaches the best distance of throwing relief materials, the corresponding relief materials will be thrown in time. At the same time, a digital camera will be equipped to transmit real-time information of drowning victims to the nearest authorities. In the rest of the time, the earth effect aircraft can also play a river, reservoir surface cleaning, general goods transport and other related uses.

4. Conclusion

The ground effect aircraft has overcome the deficiency of traditional products by using the ground effect principle. The application of new materials is lighter and easier to carry. The application of the new electric unit improves the rescue speed of the aircraft, shortens the rescue time, and creates more possibilities for the survivors. In the design process, the recyclable PP material we use has the advantages of green environmental protection, simple and durable structure, while having considerable strength and light weight. This product saves the manpower, material resources and financial resources needed for rescue, has a relatively broad market and is expected to be put into use as soon as possible.

References

- [1] Zhu Yinggu. Research on Modeling and Take-off Control of Water UAV [J]. 2013.
- [2] Wang Yanbo. Uav (Model Aircraft), CN304169561S[P]. 2017.

- [3] Du Huan, Fan Guoliang, Yi Jianqiang. Design of autonomous water Control system for water UAV [J]. Control Theory & Applications, 2015(10):11.
- [4] Du Wengong. Discussion on technical characteristics and design requirements of uAVs in water Environment monitoring [J]. Hebei Agricultural Machinery, 2018(9):1.
- [5] Liu Jie. Design and Research of Portable Water Rescue UAV [D]. Hebei University of Science and Technology.