

Modular Classified Controlled Sounding Rocket

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Introduction

- Sounding rocket, as the only field exploration tool in near space, has been widely used in space weather forecast, middle and upper atmosphere research and material processing under microgravity conditions
- Market Background**
 - Sounding rockets are developing towards the trend of small carrying and commercialization, but they are in the early stage of commercialization and the market scale is small
 - Most of the rocket models have fewer iterations, simple product structure, high customization, poor versatility, and can only meet a single scenario
- The independent design of a strong versatility, cost-effective, popular science, for the public model rocket has become the design direction and research focus

Methods – Subjects & Processing

- Model building
 - Modeling and iteration of rocket arrow body with solidworks modeling software
- Avionics system design
 - Drawing circuit boards according to the control requirements for rocket navigation
- Control algorithm designing
 - Master the tail control rotation parameters through aerodynamic analysis, write the control algorithm based on this and download it in the circuit board

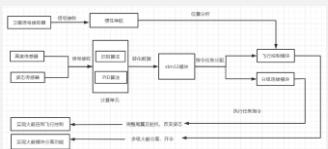


Fig. Technical approach

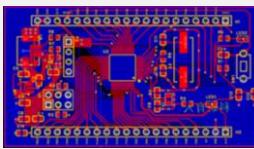


Fig. System core board

Model of the Rocket Body

Model of the rocket body includes

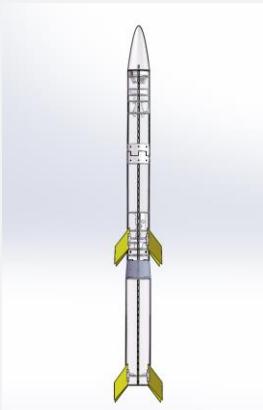


Fig. Main body model

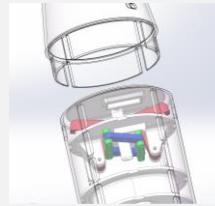


Fig. Open parachute structure



Fig. Separation mechanism



Fig. Avionics system granary

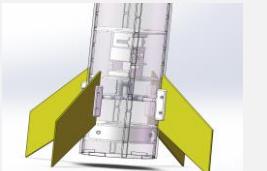


Fig. Controllable rear wing

Real-time Data Transmission from Sensors

- The position, attitude, temperature, **pitch angle**, **roll angle**, **yaw angle** and other parameters of the rocket are obtained in real time through the sensor



Fig. Sensor data feedback

俯仰角= -0.81	横滚角= 173.43	偏航角= 128.45
俯仰角= -0.81	横滚角= 173.43	偏航角= 128.44
俯仰角= -0.80	横滚角= 173.42	偏航角= 128.43
俯仰角= -0.80	横滚角= 173.42	偏航角= 128.43
俯仰角= -0.80	横滚角= 173.42	偏航角= 128.42
俯仰角= -0.80	横滚角= 173.42	偏航角= 128.41
俯仰角= -0.79	横滚角= 173.42	偏航角= 128.41
俯仰角= -0.79	横滚角= 173.42	偏航角= 128.40
俯仰角= -0.79	横滚角= 173.42	偏航角= 128.39
俯仰角= -0.79	横滚角= 173.42	偏航角= 128.39

Fig. pitch angle, roll angle, yaw angle

Results -Rocket Flight Simulation

The whole process of rocket launch, acceleration, flight, and separation is simulated by computer to predict the trajectory, speed, altitude and other parameters of the actual launch of the rocket



Fig. Rocket Flight Simulation

Conclusions & Future Research

- The model controlled sounding rocket can adjust its attitude and release the parachute stably according to the demand of **opening height**
- According to the attitude of the rocket, the ten-axis sensor controls the tail of the rocket, so as to achieve a certain attitude correction. At the same time, if the attitude cannot be corrected (**the deviation is about 55°**), the head cone is controlled to pop out to complete the parachute opening
- Optimize the design of the **parachute opening structure**
Design a more stable and simple parachute opening structure

Awards & References

- Modular Classified Controlled Sounding Rocket** won the UESTC College Students' Innovative Entrepreneurial Training Plan Program Yunhui Scholarship (**Top 7%**)

[1] ZHANG Shuliang, ZHU Jinlong, HE Yinshe, et al.Launch device of uncontrolled sounding rocket [J].China Space Science and Technology,1982(05):6-15.

[2] He Li. Research and Development of Production Equipment for PCB and Its Application in China [J]. China Integrated Circuit, 2018,27 (07): 83-85.