

The R&D of Sounding Rocket Completed, the TKU MK-1 model is Ready to Launch

Participating in the Small Research Rocket Development Project led by the Taiwan Space Agency (TASA), the Department of Aerospace Engineering of our university has successfully developed the sounding rocket "TKU MK-1" and has completed the registration of the launch vehicle with TASA. The department has also obtained the launch permit from TASA. The test launch is scheduled between May 27th and May 30th at the Hsuhai national rocket launch site. This project is led by TASA and involves the participation of several universities, including National Yang Ming Chiao Tung University, Feng Chia University, and others. Our university will be the first private university in Taiwan to have the capability to launch rockets to several kilometers' altitude.

The "TKU MK-1" rocket has a diameter of 12 centimeters, a length of 182 centimeters, and a mass of 34 kilograms. It has a maximum speed of 340 meters per second and can reach an altitude of 5 kilometers. It uses a solid rocket engine with a total impulse of 13,000 N·s, making it a relatively large-scale rocket for amateur use. The aerospace department and its faculty and students have been conducting technical R&D since 2017. Originally, the launch was planned to take place at the Hsuhai area in Pingtung County at the end of 2022. However, due to site renovations, the launch was postponed to May of this year. Professor Yi-Ren Wang, the principle investigator, stated that since the team has no previous experience in launching large rockets, the main objectives of this test launch are twofold: 1. To test the team's ability in system integration; 2. To test the communication and telemetry systems in preparation for future rocket launches. Professor Wang also expressed gratitude to the faculty and staff at the Lanyang campus for their assistance in successfully testing the engine on 3 occasions.

Professor Fu-Yuen Hsiao, the Chair of the Aerospace Department, stated that the manufacturing cost of the rocket is as high as 800,000 NTD. Fundraising is one of the most challenging parts of the entire R&D

process, as the manufacturing cost of each rocket exceeds 400,000 NTD, not including other expenses. Moreover, rockets that have completed thrust testing cannot be reused. Without sufficient funds, it would be insufficient to cope with the system integration capability that a complete rocket should have, thus requiring a large investment in rockets.

The exterior and aerodynamic design of TKU MK-1 rocket was carried out by Guang-Cheng Bao, a third-year graduate student from the Department of Aerospace. The design aimed for simplicity and high reliability, with the main structure being a single solid rocket engine. The front end was equipped with a nose cone, avionics system, and the rear end was fitted with fins for stability. Through computer calculations, the center of pressure was positioned 2.5 times the diameter length behind the center of mass, ensuring stable flight," said Guang-Cheng Bao.

"Although there were doubts about the feasibility of my technology from the aerospace community since the beginning of the development project, I believe that true skills are not afraid of challenges. The successful ground tests of the rocket engine have proven that my design is sound. Regardless of whether the launch is successful or not, I have faith in my practical skills and mathematical capabilities. This is a significant attempt for me, the Department of Aerospace at Tamkang University, and even the amateur rocketry community in Taiwan," Guang-Cheng Bao added.

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