

## Tamkang University's Research Sounding Rocket "Polaris" Successfully Launched

At 6:28 AM, August 5, Tamkang University successfully launched the third scientific sounding rocket "Polaris" at the National Science and Technology Council (NSTC)'s Short-Term Research Sounding Rocket Launch Site in Xuhai, Pingtung. This launch marks the 7th mission at the launch site, with the Tamkang University team participating in 3 of these missions. The university places great importance on this mission, with Vice President for Academic Affairs, Dr. Hui-Huang Hsu and former Vice President for Academic Affairs, Dr. Chao-Kang Feng, both visiting the site to offer their support.

Polaris has a total weight of 58kg, a length of 3.08m, and a maximum diameter of 16.32cm. It is designed to reach a simulated altitude of up to 5.8km, with an average thrust of 2,765N and a maximum thrust of 3,734N. The burn time is 9.5s, and the total impulse is approximately 26,481N-s. Due to the replacement of the avionics board yesterday, the team could not capture all flight data in time and will conduct further analysis. According to the Chair of the Aerospace Engineering Department, Dr. Fu-Yuen Hsiao, the rocket was successfully launched, and the parachute compartment (including avionics) separated from the rocket body as per the design mechanism. However, the parachute did not deploy. It is believed that the issue with the avionics board may have caused the parachute separation mechanism to activate prematurely, leading to the final trajectory deviating from the original plan. Based on current video footage and data analysis, the maximum altitude reached was around 4 kilometers. If not for the premature separation of the parachute compartment, it was expected to exceed 6 kilometers.

He also explained that the purpose of the small sounding rocket development project is to cultivate talent in space systems engineering and promote technological innovation. Tamkang University's 3 rockets use RNX, which differs from traditional solid fuels. RNX is stable, making it highly suitable for talent cultivation within a safety-conscious campus

environment. He also mentioned that in the past, this type of fuel was only known among amateur rocket enthusiasts, so engines with such high thrust had never been built. He said, "Through the small-sounding rocket development project, our department has introduced this fuel and improved it, which could also inject new technology into the future development of rockets in our country."

The Principal Investigator (PI) of the project, Professor Yi-Ren Wang from the Aerospace Engineering Department, stated that the "Polaris" rocket is built upon the foundation of the "Jessie" rocket, with improvements made to the design and manufacturing of the composite material rocket body. It is equipped with 2 special scientific payloads: one is a vibration damping ring, used to reduce vibrations generated in the rocket body during ascent; the other is a magnetometer module, which measures the correlation between the three-axis magnetic field variation frequency and the rocket's vibration frequency. This is the first time such an experiment and research have been proposed in the international academic community. The data obtained from the test flight will contribute to the future development of sounding rockets.

The mission's co-commander and captain of the "Space Technology Laboratory" student team, Jih-Yang Yuan, a third-year aerospace engineering student, said that this test launch was the final mission of a three-year project. The rocket was named "Polaris" hoping that this sounding rocket project, like the North Star, would guide the team to continue moving forward. He mentioned that the team only breathed a sigh of relief after seeing the rocket successfully launch. He also shared that the most exciting part was the successful separation and recovery of the parachute compartment on the first attempt, and after a year of hard work, they were thrilled to finally see the results.

NSTC stated that the space industry has seen rapid development in recent years, and Taiwan's strengths in information and communication technology, semiconductors, and precision machinery make it well-positioned to enter the international supply chain. Over the past 30 years, TASA has successfully implemented satellite programs, mastering satellite

development, integration, testing, and control capabilities. Last year, TASA initiated a new orbital rocket development program with the aim of mastering launch technology, further enhancing the autonomy of satellite programs. To this end, they continue to commission the academic community to conduct scientific research rocket programs to cultivate talent in related fields.

The Aerospace Engineering Department at Tamkang University has a strong faculty team in the field of space technology. Faculty members involved in this project include Department Chair Hsiao, who is one of the few professors specializing in astrodynamics and satellite orbits. Since 2022, he has been part of the National Cheng Kung University CubeSat team, working on the advanced orbit control design for the "Lilium 2 & 3 CubeSat" constellation project, which is scheduled for launch in 2025. The PI of the project, Professor Wang, specializes in vibration analysis and system damping. Additionally, Associate Professor Chien-Chun Hung focuses on composite materials and antenna design, while Assistant Professor Kaiti Wang, who previously worked at NASA's Jet Propulsion Laboratory (JPL) in California, specializes in space radiation, electromagnetic propagation, interplanetary satellite missions, and magnetospheric waves and particles.

The Aerospace Engineering Department executed the TASA small scientific research rocket development project, conducting a total of 3 test flights. The first launch, "TKU-1," in June 2023, was to verify rocket development and system integration capabilities. The second launch, "Jessie," in September 2023, was to validate the structural design of the composite rocket body and carry scientific payloads. This latest rocket, "Polaris," is an improvement over "Jessie." It is still a single-stage rocket using the emerging RNX solid propellant, but with increased thrust, targeting an altitude of 5 kilometers. In addition to further verifying the rocket's vibration damping and scientific payload design, this mission also included a parachute system to recover the rocket's avionics section.

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Vice President for Academic Affairs, Dr. Hui-Huang Hsu, and former Vice President for Academic Affairs, Dr. Chao-Kang Feng, both visited the site to offer their support and took a group photo with the faculty and students of the Aerospace Engineering Department.

The Space Technology Laboratory team assembled the rocket.

