A Fully Self-Developed and Completely Open-Sourced, Affordable Rocket Module Featuring an Interchangeable Secondary System for Versatile Mission Adaptability

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This project introduces a fully self-designed, completely open-source, and affordable rocket module aimed at addressing real-life challenges that cannot be effectively solved by existing technologies, such as cleaning space debris and the gap of versatile small-scale rockets. We enhance the accessibility and safety of rocketry by independently developing a modular, cost-effective, and reconfigurable prototype.? A significant focus of our exploration was the innovation of rocket fuels. Initially, we synthesized our custom ammonium perchlorate-based propellant from common household items (table salt). Building upon this, we experimented, synthesized, and tested DNOAF, a highly energetic compound whose exceptional specific impulse and clean combustion products we explored. Furthermore, we developed a safe, electrically controllable HAN-based solid propellant that ignited solely by applying voltage and can be throttled by controlling that voltage. This design has versatile applications, including throttling the rocket's main engine, active control systems, and even flying drones in space.? In addition, we independently designed the rocket motors, flight computers, and a packable, soft, collision-resilient drone that can be deployed from the rocket. We conducted twelve field tests and rocket launches to analyze and calculate total impulse and stability, experimenting with self-machined motor design to optimize rocket performance. The effectiveness of the flight computing system was evaluated through MATLAB simulations.?

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