# Optimizing Rocket Design for Maximum Altitude in Thailand CANSAT - ROCKET Competition 2022



## INTRO

The aeronautical and space engineering landscape in Thailand is still in its early stages, with ongoing efforts to cultivate interest and expertise in the field. The Thailand CANSAT - ROCKET Competition 2022, organized by the National Science Museum (NSM) and the Defence Technology Institute (DTI), , offers a unique opportunity for high school students to explore aerospace engineering. This research is centered on the design optimization of rocket components, specifically the rocket nose cone and fins, to improve performance and maximize altitude in the competition. This project is supported by SPACE AC Institute of Technology.

## METHOD

Our investigation commences with a thorough analysis of various rocket head shapes and their impact on aerodynamic performance. Using the OpenRocket program, simulations were conducted for shapes such as Von Karman, LV-Haack, 0.5 Parabola, 0.75 Parabola, Ellipsoid, Conical, Tangent Ogive, and Secant Ogive. Detailed analysis of drag forces, covering Nose Cone Pressure Drag, Nose Cone Friction Drag, and Body Friction Drag, revealed distinct graph patterns. Recognizing limitations in accurately simulating the Von Karman curve, we made informed assumptions based on observed drag behavior in other nose cone shapes, leading to the selection of a 12-centimeter Von Karman rocket head. Continuing our exploration, we delved into the factors influencing the height of trapezoidal rocket fins. Prioritizing trapezoidal fin design, OpenRocket simulations were employed to optimize the fin tip chord length, ensuring a delicate balance between altitude and rocket stability. The final decision led to a 2-centimeter chord length at the fin tip, a critical variable in achieving overall rocket performance.

## OUTCOME

During the presentation phase, skepticism arose regarding simulation results indicating an altitude of 652 m, surpassing the expected maximum of 600 m. Double-checking revealed no simulation issues. In the launch, the rocket achieved 577 m, slightly deviating from the simulation but securing the highest altitude. Despite this discrepancy, our efforts culminated in the rocket receiving the esteemed Best Aerodynamics Award at the Thailand CANSAT - ROCKET Competition 2022