

Aimouch, M., Bennett, W., Raythatha, R., Ruiz Pena, E., Tirupati, A., Everheart, J., Dahshi, M., Sharma, A., Quillin, N.

Executive Summary

High-power rockets designed for competition must achieve precise apogee targets while maintaining stable flight. However, uncontrolled roll motion and aerodynamic uncertainties can significantly reduce trajectory accuracy.

To address these challenges, AeroMavs developed Atlas, a 10,000 ft competition rocket integrating an active roll control system and deployable air brakes. These systems aim to improve flight stability and dynamically adjust altitude during ascent.

Experimental Setup

The Atlas rocket includes:

- Flight computer with dual altimeters (redundancy)
- Roll control actuators (servo-driven system)
- Air brake deployment mechanism
- GPS tracking system
- Reinforced body tube (camera cutout region)

Testing performed:

- Bench testing of electronics
- Ejection charge validation
- GPS transmission/receiving tests
- Battery endurance testing



Experimental Results

Key observations:

- Roll control system reduced undesired rotation during testing
- Air brake deployment showed potential for altitude correction
- Redundant altimeters improved system reliability
- Structural reinforcement prevented failure near payload cutouts

Highlights:

- First AeroMavs rocket with active roll control + air brakes combined
- Designed for precision apogee targeting (~10,000 ft)
- Integration of control systems + structural improvements
- Emphasis on failure analysis and iterative design

Background

Traditional rockets rely on passive stabilization (fins), which cannot correct in-flight disturbances.

This project introduces:

- Active Roll Control System → minimizes rotational instability
- Air Brake System → increases drag to reduce overshoot
- Sensor-based feedback loop → enables real-time control decisions

These technologies are critical for precision competitions such as IREC (International Rocket Engineering Competition)

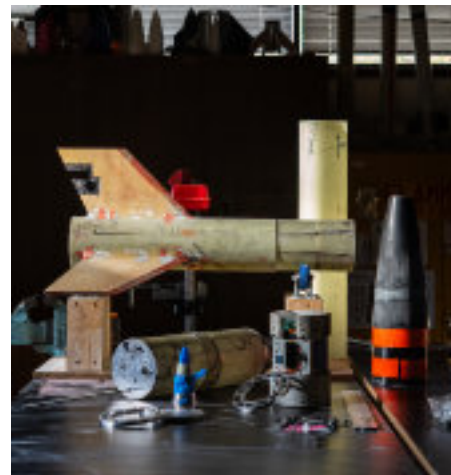
Experimental Test Plan

The system was validated through the following tests:

- Upper Ejection Test → Main parachute deployment
- Lower Ejection Test → Drogue parachute deployment
- Battery Drain Test → System endurance validation
- GPS Tx/Rx Test → Communication reliability

Future testing includes:

- Integrated system testing
- Flight readiness validation
- Full-scale launch simulation



Conclusions

Atlas demonstrates that integrating active control systems into high-power rockets significantly improves flight stability and performance.

The combination of roll control and air brakes provides a foundation for closed-loop trajectory correction, enabling more accurate competition results.

Future Work

- Implement full closed-loop control (real-time feedback adjustment)
- Improve actuator response time
- Optimize air brake geometry for better drag control
- Expand testing under varying flight conditions
- Enhance data analysis for predictive modeling