Design and Fabrication of a Boosted Dart Rocket System

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Overview
A boosted dart consists of two stages, the powered first stage known as the booster and the unpowered second stage or dart. The rocket was designed to facilitate collection of IMU data throughout the flight as well as downward facing video.

Impact
The boosted dart system is an economical method of achieving a higher altitude per propellant mass compared to traditional single stage systems.

Key Findings
The IMU payload was able to characterize the spin of the rocket despite its high rotational velocity. The system also verified that fins, electronics sleds, nose cones, and rail buttons made via additive manufacturing processes are a viable solution to high power rocketry construction.

Explaination
The project demonstrated the efficiency of staged rockets and is analogous to much larger scale rocketry. A boosted dart is simpler than most multi-stage systems by only using a single propellant, similar to a single stage rocket. However, by separating the first stage in flight, drag is reduced, and a higher altitude is achieved.

Predicted (OpenRocket)          Actual
Booster Apogee (ft)      2807    2877
Dart Apogee (ft)         4944    4950
Separation (ft)          2137    2063
Average Acceleration (Gs) 21.7    21.5
Top Speed (mph)          505     495

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