NW Sandia Senior Design Bonanza: Flight Accelerometer Switch

Sandia National Laboratories

Motivation

Sandia would like to improve its agility to design, build, test, and produce new products. As a case study, Sandia is requesting that teams design, prototype, test, and produce a launch profile detection system, also known as a Flight Accelerometer Switch (FAS) for an EggTosser Rocket.

- Traditionally, designing, building, testing, and producing, components, subsystems and systems takes multiple years
- These systems are expected to remain functional (in storage) for the life of the program, up to 40 years
- There is a strong desire to improve agility, while reducing cost and maintaining quality

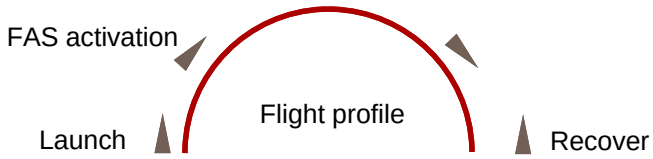
Objective

Design, prototype, test, and produce a FAS, which detects acceleration, either by time integration or maximum acceleration and then closes a switch (creating a signal path) once a threshold is reached. The closing of the FAS triggers the recording of elevation and time. The FAS should remain closed and continue recording throughout the flight time.

- Use engineering analysis and tools such as modeling and simulation to validate design selection and experimental results
- Design, prototype, test, and build a functional FAS

FAS Requirements

- Mechanical envelope, ~chicken egg (geometric volume)
- Single axis switch, mechanical in nature, scalable, reliable, and not a commercially off the shelf part
  - The switch closes a unique signal pathway (optical, electrical, electromagnetic, acoustic, etc.), and triggers the recording of elevation and time.
- Maximum weight 50 g, ~large chicken egg
- Resettable/reusable
- Robust to environments exposed to during launch and recovery
- Activate based on EggTosser Rocket launch profile
  - Aerotech Motor - D21-7T
    - Maximum thrust: 17.7 N
      - Burn time: 1.9 sec
- *Stretch goals*
  1. Minimize weight (i.e. maximize elevation)
  2. Inflight recording of: position (x,y,z), velocity, acceleration, rotation and temperature
  3. Live tracking and transmission of flight profile and FAS status to on-land location



For the competition, Teams will be evaluated based on: Requirements, FAS design, Weight of FAS, Projected FAS cost, Uses and validation of modeling and simulation, and Maximum elevation achieved during flight.

References

Space vehicle accelerometer applications, https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/19730018164.pdf

EggTosser Rocksim, https://www.apogeerockets.com/Rocket-Kits/Skill-Level-3-Model-Rocket-Kits/EggTosser

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