Aerospace Technologies Team Hōkūlele: Two-Stage High Powered Rocket

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Introduction & Motivation

Team Hōkūlele is a Vertically Integrated Project (VIP) with freshman through senior year members dedicated to promoting the University of Hawaii’s pursuit of excellence in education, research, and service in the field of aerospace technology. Team Hōkūlele provides students with the opportunity to gain experience in the field of high-power rocketry and aerospace engineering through the practical application of engineering concepts. In addition, students are a part of a team competing at the collegiate level and are gaining hands-on experience in rocket design and fabrication. Through our competition and community outreach, we hope to inspire Hawaii’s next generation of students to pursue an education and/or technical careers in Science, Technology, Engineering, and Math (STEM) fields that will shape Hawaii’s economy and future as well as drive forward the aerospace industry.

Team Hōkūlele has designed and is building a two-stage high power rocket capable of reaching altitudes above 25,000 feet. The rocket will house three individual payloads to demonstrate the capability of not only developing a high-powered rocket but a full system test bed for hardware development and testing. For this year’s rocket the three payloads are a 1U CubeSat, a CanSat Payload, and a camera array. The rocket will be launched at the Friends of Amateur Rocketry (FAR) 1030 Competition in the Mojave Desert, California.

Materials

Nose is made of a wound fiberglass transition with a 8 steel tip. A threaded rod and wooden bulkhead are used for internal support structure and house adjustable ballast. Centering rings and bulkheads are made of Nomex honeycomb core, all wrapped with twill woven Carbon Fiber. The Body Tubes and Motor Tubes are made of filament wound fiberglass.

Payloads

CubeSat: Provided by Team Makani
• Dimensions: 10cm x 10cm x 10cm
• Weight: 1 kg
• Insert payload to test structure of 1U CubeSat during rocket flight

CanSat: Provided by Dr. Miguel Nunes HSFL
• Provided by Team Makani
• Deploy a glider
• Gather environmental data
• Transmit live video of flight

Payloads

S4000 Black Camera: Provided by team advisor
• Dimensions: 10cm x 10cm x 10cm
• Weight: 1 kg

Each fin is comprised of a FR4 fiberglass frame with Nomex honeycomb core, all wrapped with twill woven Carbon Fiber.

Conclusion

• Team Hōkūlele will compete in the Friends of Amateur Rocketry (FAR) 1030 competition in order to test the first iteration of a two-stage solid motor rocket system with deployable payloads.
• The rocket will carry two inert payloads and one deployable CanSat glider to serve as the first hardware/software demonstrations to use the launch vehicle as a test bed for future demonstrations.
• This project is not only a senior design project but as a VIP, our team members have learned and demonstrated the basics of modern high-powered rocketry including motor selection, fabrication/assembly, flight profile design, system integration and experienced the full cycle of an engineering process.
• Team Hōkūlele provides students the opportunity to become certified in high powered rocketry through an annual certification program held in Nevada with Dr. Jacob Hudson (WCC)
• The competition also provides students with an opportunity to network with industry professionals as they regularly attend the competition to interact and judge the rocket systems.
• Team Hōkūlele also serves as an introduction into the field of aerospace engineering by introducing topics such as gas dynamics, high speed flight and rocket propulsion.

References

1) FPV Camera: https://aaddspfc.com/products/31
2) 1U CubeSat: https://www.teepro.com/cubesat-platform
3) SJ Cam: https://sjcam.com/product/sj4000/

Acknowledgements

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Further Reading