The UAH Space Hardware Club
Sounding Rocket Program

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Space Hardware Club

- Student led organization that designs, builds, tests, and flies aerospace related hardware
- 200+ members
- 10 degree programs
- 9 active project teams
- 57 ballooning missions
Rocket and Rover Competition

- **Darkstar - 2012**
  - 1st rocket built by SHC
  - Major fairing failure caused disqualification

- **Magnum - 2014 (above)**
  - Reliable fairing and recovery
  - Placed 2nd in competition

- **Spitfire - 2016 (below)**
  - Very reliable and efficient
  - Placed 2nd based on design review scores
Heritage - CanSat

- Mock-Satellite Competition
  - **Blacklung - 2012**
    - 2nd rocket built by SHC
    - Flew on a 38mm motor (Level 1)
  - **Sherman - 2014**
    - Resilient but a little over-built
    - Flew on a 54mm motor (Level 2)
  - **Awww Thanks - 2016**
    - Current CanSat testing rocket
    - Flies on a 38mm motor (Level 2)
Heritage - Boosted Darts

- Boosted Darts built for Midwest High-Power Rocketry (left) and IREC (right)
- Only previous projects with multistage designs

**Midwest High-Power Rocketry**
- Flew on a 1 grain 54mm solid motor
- 54mm minimum diameter booster to 38mm upper stage

**IREC**
- Flew on a 2 grain 75mm motor
- Never flew in final configuration
L1 Month

- Training Newcomers to learn how to build rockets from scratch
- Earn certifications to build bigger and faster rockets
- Lay up all fiberglass components by hand
- Only bought nose cones, recovery equipment, and rail buttons
• Started with 22 people without certifications
  ▪ 16 successful L1 certifications
  ▪ 1 L2 certification
  ▪ Learned a lot about hand-laid composites
  ▪ Formed a new educated generation for the SHC Sounding Rocket Program
The Supersonic Challenge

- **Supersonic Challenge**
  - Challenges 2 teams to design, build, and fly a rocket that travels at least Mach 1 with an apogee between 5,000 and 10,000 feet

- A friendly competition within Space Hardware Club established by experienced club members
  - 40% Design Reviews
  - 50% Flight Performance
  - 10% PFR

- The goal of the Supersonic Challenge is to train a new generation of SHC engineers in supersonic rocketry
The Supersonic Challenge Cont.

- **Mach 6**
  - Apogee: 9,400 feet
  - Max Velocity: 1,720 ft/s (Mach 1.53)
  - Motor: AT-K1275
  - Mass: 3,823 grams
  - Diameter: 2.125 inches (minimum diameter)

- **Gold Team**
  - Apogee: 9,400 feet
  - Max Velocity: 1,172 ft/s (Mach 1.04)
  - Motor: AT-K1275
  - Mass: 4,622 grams
  - Diameter: 3 inches
● Mach 6 (top) used thick fins to increase drag and stay within the altitude requirements
● Gold Team (bottom) experiences less drag overall, despite having a larger diameter than Mach 6
  - Drag force - 70 lbf vs. 90 lbf
Project URSA

- Project URSA is the cornerstone of the Space Hardware Club Sounding Rocket Program
  - First SHC project to attempt two powered stages
  - Team of 10 developing rocket
  - Completed initial testing
  - Ultimate goal of 31,000 feet and Mach 1.75
  - Using a custom avionics package specifically for URSA
Rockoon

• The mission
  - Developing a mission concept for a suborbital launch vehicle that will employ a high-altitude balloon to assist a rocket and bypass significant atmospheric density for extremely high-altitude flights

• Purpose
  - To provide cheap high-altitude experimentation to small companies

• How it works
  - The rocket will launch near balloon apogee and boost the payload higher than possible on a high-power rocket or balloon alone
Conclusion

- Space Hardware Club has 9 active project teams
  - 5 teams include rocketry
- The purpose of the Sounding Rocket Program is to expand the students’ knowledge, experience, and capabilities.
  - Prepares the members for success in their future careers
This project would not be possible without:

- Club Advisor
  - Dr. Francis Wessling, UAH MAE department
- Project Funding
  - Dr. John Gregory & Alabama Space Grant Consortium
  - Dr. Mahalingam, Dean of the UAH College of Engineering
The Space Hardware Club at UAH is a volunteer student organization dedicated to the design, development, fabricating, testing, and flying of student engineering and science hardware, to make students better engineers. Find out more about SHC Projects, and how you can help, at space.uah.edu.