UB SEDS Fill System Grant Proposal

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Well formatted header and properly sectioned topics

Introduction

UB SEDS is the *Students for the Exploration and Development of Space* (SEDS) chapter for the University at Buffalo located in Amherst, NY. We are a student-led club that organizes technical and community outreach projects for space education. Our largest technical project is a *student researched and developed* (SRAD) hybrid motor, L3 rocket for the *International Rocket Engineering Competition* (IREC) in Midland, Texas. In addition to our L3 rocket, we have a battle bots team that competes at the university, an HPR team to help individuals earn L1 certificates, and an astronomy team to provide educational astronomy outings. Recent community outreach projects include volunteering at a local high school rocketry competition, tabling at the Buffalo Science Museum, and hosting a bottle rocket challenge on our campus. Each year we build a new L3 rocket for IREC and look to improve upon our previous year's design. One of the major projects we have taken on this year is a newly designed fill system for radio communication, data acquisition, and launch sequence tasks. This new fill system will create a simplified electrical solution for our propulsion team when it comes time for launch day. We previously received funding from SEDS USA for our fiber-optic gyroscope project (image 1) which acted as the payload for our L3 rocket. This project was completed in December and will be tested in flight this June.

Image 1: Payload fully assembled

Properly formatted pictures verify legitimacy and supplement text information

This introduction is detailed and informative, providing an overview of their chapter and ending with a strong transition into the project this proposal concerns.

Project Description

Strong technical overview with relevant images

Inside the fill system there are three major electrical systems, gateway, actuators, and data acquisition. The gateway system allows for communication with our rocket via an ESP32 radio which operates at 2.4GHz. It also regulates power using the TPS25947 for voltage and current sensing. A buck converter and LDO can then be used to get 5V and 3.3V power lines for distribution. The actuators control everything for our launch sequence. This includes the purge valve, fill valve, motor ignition, and motor drivers. This board utilizes high current cabling for controlling actuators and stepper motors. The data acquisition board is the team's solution to UB SEDS' lack of reliable, remote-controlled instrumentation.

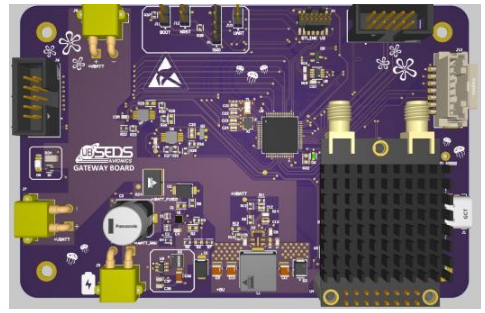

Image 2: Gateway PCB 3D model

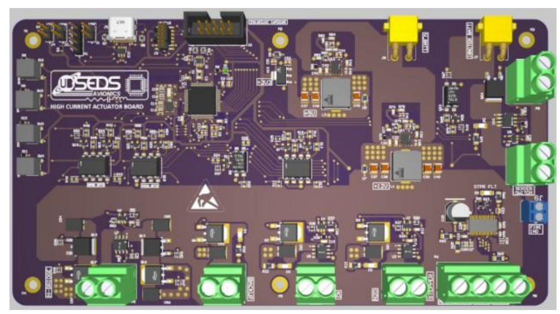

Image 3: Data Acquisition PCB 3D model Gateway PCB 3D model

The DAQ carries eight precision voltmeters accurate to single-digit microvolts and capable of millions of measurements per second, two current sensors that can withstand over 10 amps each, and two numerically controlled signal generators. In addition, the DAQ has an integrated power supply, multiple digital IO ports, and a micro-SD card slot for storing data. All three PCBs use an STM32 microcontroller which will be coded by our software team in Rust to ensure data reliability**.** We have the capability to log large amounts of high-frequency flight data efficiently while keeping file sizes small and easy to manage. Because the data is structured and indexed, it can be quickly queried for live display or post-flight analysis. The entire fill system is open source. This allows collaborators, reviewers, and future teams to understand exactly how the system works. It promotes transparency, reproducibility, and long-term sustainability. In addition to the electrical systems, our structures team will help design a 100% waterproof sealed box for the PCBs to be mounted inside. A single connector will exit the box and connect from the gateway board to our rocket for communication while it is on the launch pad. This project highlights the interdisciplinary work that our club does combining the expertise of our hardware, software, and structures teams.

Proves recurring impact

Highlights interdisciplinary work

Project Management

Clear timeline with dates and actionable items

At this time, we have all three *Printed Circuit Boards* (PCBs) designed and CAD drawings for the full assembly. The next step, with the help of funding from SEDS USA, would be to order the PCBs and their components for assembly and testing. After we have confirmed functionality of all the PCBs individually, we can assemble the final system for use in static test fires leading up to the competition. Based on our current progress and what we hope to achieve, a realistic timeline would see the PCBs assembled by the end of March. Once we can place and receive the orders for the electronics, it only takes 2 weekends maximum for us to solder the PCBs. This would leave us all of April and the beginning of May for testing and troubleshooting so that we can have the final assembly completed in mid-May. Following this timeline, we will have our fill system fully functional for competition in June and have wiggle room for any roadblocks along the way. We have leads assigned to every aspect of this project including an overall project lead, actuator lead, gateway lead, data acquisition lead, structural lead, and software lead. Underneath each lead is a team of students working to perfect their sub system. In addition to the design work each lead takes on, it is their job to ensure that the members of their subsection learn all the skills required for the project. Throughout the design process meetings occurred three times a week for the leads to give instruction and assign work to the members of the group. This schedule will continue for testing once the PCBs are assembled.

Provides clear idea of what their funding request is for

Timeline is realistic with explanations

Detailed leadership structure

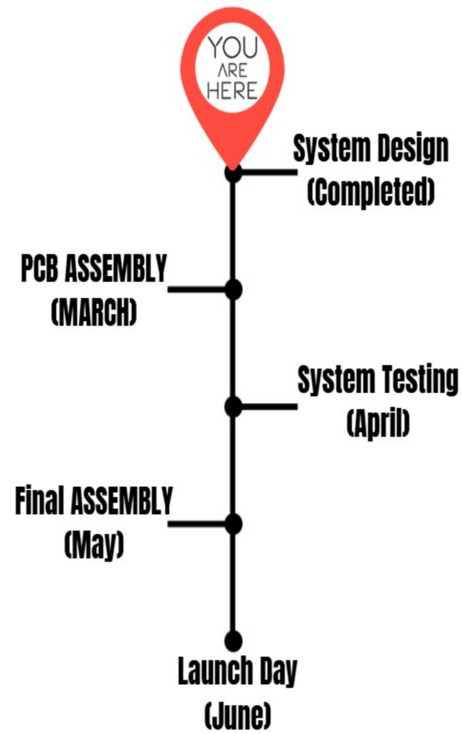

Image 4: project timeline

Significance of project is clearly stated in multiple ways

Technical Benefits

The new fill system would act as a “plug and play” black box for our propulsion team. Creating this new standardized system and putting it through rigorous testing, we will remove any electrical issues that occur during our launch sequence. This will allow the propulsion team to focus their efforts on perfecting our hybrid motor. The data acquisition functions will allow us to get much more accurate data using load cells. This includes rocket weight, feed tank weight, and combustion chamber pressure. Although the project is designed for this year’s competition, its operations can be applicable to future rocket designs, meaning this fill system will be an integral part of the club’s operations for years to come.

Proves re-usability of project

Educational Benefit

Throughout the project members will learn key technical skills. Up to this point in the design process, industry standard programs including Altium Designer and Autodesk Fusion have been used. Altium allows us to design our PCBs, lay out the components, and export 3D models. The 3D models can then be used in Fusion to decide the best layout for our electronics inside the box along with solutions for mounting them. Assembling the PCBs will give members an opportunity to learn how to hand solder and use a reflow oven. This includes learning proper safety protocols to protect themselves and the equipment. In the testing phase, members will learn how to test PCBs by identifying problems and tracing them to the source using equipment such as vector network analyzers and oscilloscopes. Members will see what developing the project looks like from the starting design phase all the way to integrating parts into the final system.

Image 5: Full assembly Fusion model

Shows direct value to students

Detailed breakdown with individual costs

Project Budget

PCB Stencils	$28
Data acquisition PCB	$128.3
Gateway PCB	$100.4
Actuator PCB	$104.8
STM32 microcontrollers	$29.68
Transistors	$25.51
Resistors	$48.42
Capacitors	$45.248
Diodes	$12.56
Connectors	$127.96
Texas Instruments IC’s	$52.43
Voltage Converters	$32.47
Radio and antenna	$199
Waterproof storage box	$53.99
Misc. hardware (screws, bolts, etc.)	$35
TOTAL COST	**$1,026.77**

Chart 1: Total fill system budget

The chart above shows a breakdown of the total project budget. This includes the bare PCBs, their components, and hardware for mounting all the electronics. UB SEDS is requesting a grant of $1,000 to help cover the cost of buying the equipment required for this project.

Conclusion

Strong conclusion reiterating main points and value

This project will be a major steppingstone for UB SEDS to achieve a consistent and standardized launch procedure. It will also enhance our capabilities to record and analyze pre-launch data including the weight of the rocket and the launch pad's oxidizer tanks. Members of the team will learn important skills including circuit design, CAD, troubleshooting, and interdisciplinary teamwork. After having completed the design phase and putting together a team of experienced and dedicated project leads, we are confident we can have this project completed for launch day in June. Thank you for considering UB SEDS for the Spring 2026 chapter grants.