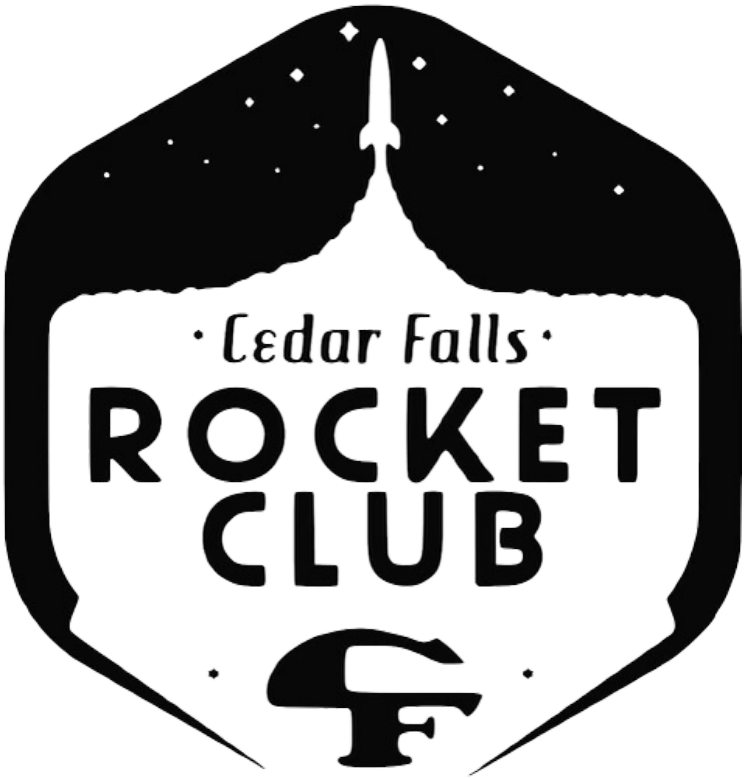
Project Hrafn

Proposal



Cedar Falls High School

1015 Division Street, Cedar Falls, IA 50613

September 19th, 2022

Table of Contents

I) General Information

1.1 Adult Educators

- Mr. Zeb Nicholson zeb.nicholson@cfschools.org (319) 939-2169
- Ms. Autumn Weaver autumn.weaver@cfschools.org (641) 512-6741

1.2 Adult Mentor

- Mr. Tyler Sorensen tylersorensen3@gmail.com (319) 269-2592
    - NAR #: 99437, TRA #: 16311, Level Two Certified

1.3 Student Team Leader

- Torin Brown 23torbro@student.cfschools.org (319) 290-5975

1.4 Student Safety Officer

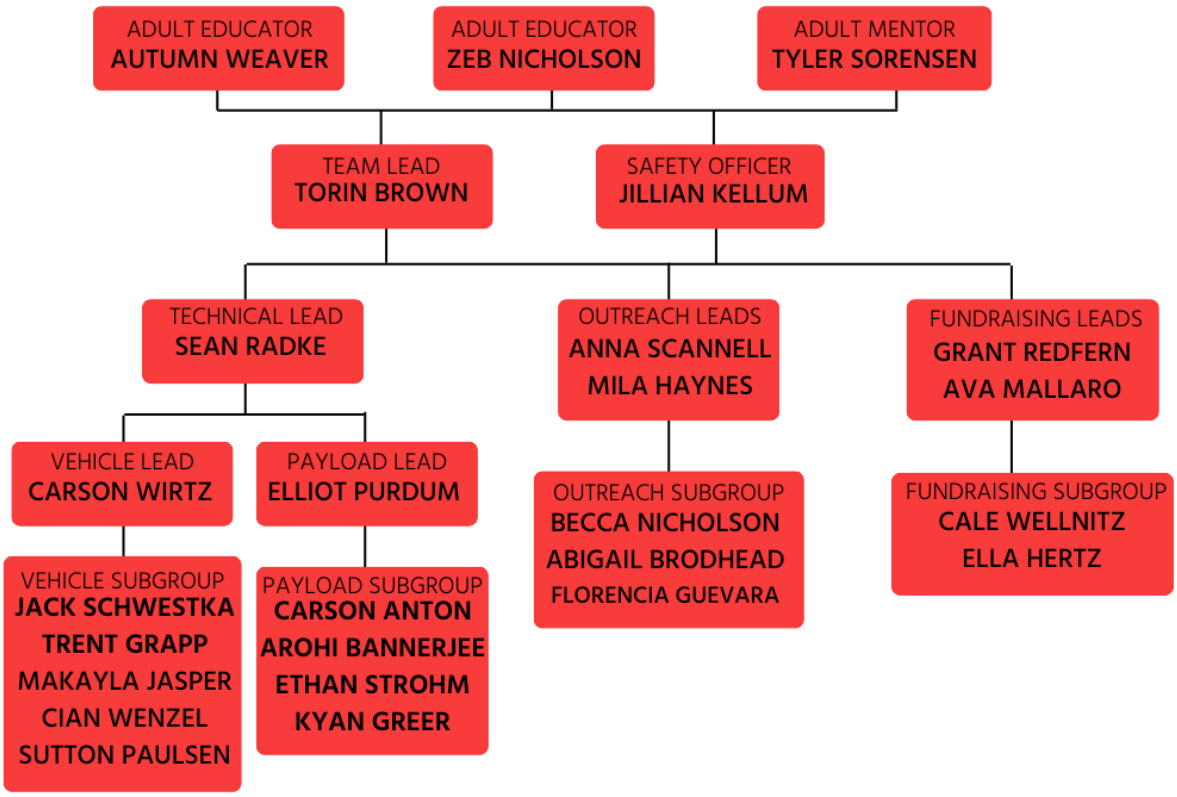
- Jillian Kellum 23jilkel@student.cfschools.org (319) 229-9094

1.5 Team Members and Their Roles

- An approximate number of student participants who will be committed to the project and their proposed duties. Includes an outline of the project organization that identifies the key managers and technical personnel.

The CFHS Rocket Club Team currently has 23 students, two adult educators, and one mentor. The students consist of 11 females and 12 males; 16 seniors, 5 juniors, and 2 sophomores. The first adult educator, Zeb Nicholson, is the coach and a teacher at Cedar Falls High School. He has spent the last eight years leading the rocketry team and has past mechanical engineering work experience. Autumn Weaver, the team's second adult educator, has been with the team since last winter. She has a degree in All Science - Secondary Education and teaches Physics at Cedar Falls High School. The mentor this year, Tyler Sorensen, is a former member of the CFHS Rocket Club and the University of Wisconsin - Platteville 'Pioneer Rocketry' team. He has held several positions on these teams including Safety Lead and Vice-President. Mr. Sorensen will supervise vehicle construction and oversee motor assembly, energetics, and anywhere else that help is needed.
The team is divided into four subgroups: Vehicle Design/Construction, Payload Design/Construction, Outreach, and Fundraising. Each subgroup has a leader responsible for their section to ensure their respective parts are completed, delegate tasks, and ensure productivity. The subgroup leaders report back to the Student Team Leaders, and assistance is

provided where necessary. The Technical Lead provides additional oversight over both the vehicle and payload, assisting where necessary. The adult educators, mentors, and Student Team Leaders are open to answer any questions, problems, or difficulties in order to support the team whenever it is needed.



1.6 NAR/TRA Section Affiliation

- The team will work with the Tripoli Minnesota Association, TRA Prefecture #45, for mentoring, reviewing designs and documentation, and launch assistance.

1.7 Project Proposal Time Log

- The team has spent a total of 207 hours brainstorming, developing, designing, and producing this proposal in the span of 19 days. The team had multiple meetings during school hours and after-school hours. These hours recorded have been divided across the

teams' four subgroups. These groups have focused on their respective parts of the proposal while also working together to create a project that the team as a whole is motivated and enthusiastic to work on throughout this school year.

1.7 Available Time Slots for Design Review Presentations

- Monday 12:30-1:30 PM and Tuesday through Friday 12:00-1:00 PM

1.8 Letter of Administrative Support

Cedar Falls High School Administration,

For the 2022-2023 school year, the following students will be involved in the NASA Student Launch Initiative team with the CFHS Rocket Club. This letter is to inform you of multiple required meetings the student participants will need to attend throughout the school year. Early communication allows for you to be aware students may need to be excused from class during set meeting times. CFHS Rocket Club mentors will provide early notices for the dates and times of each meeting. This document certifies that the Cedar Falls High School Administration is in support of the students using this valuable time to present their project and its respective updates to NASA.

10th Grade - Sophomores
Kyan Greer
Trenton Grapp

11th Grade - Juniors
Becca Nicholson
Jack Schwestka
Mila Haynes
Elliot Purdum
Cian Wenzel

12th Grade - Seniors

Sean Radke	Cale Wellnitz	Carson Anton
Torin Brown	Carson Wirtz	Sutton Paulsen
Jillian Kellum	Grant Redfern	Arohi Banerjee
Ava Mallaro	Makayla Jasper	Anna Scannell
Florencia Guevara	Ella Hertz	Gavin Denholm

Adult Educator
Name (Printed): Zeb Nicholson Signature: [signature] Date: 9/9/2022

Assistant Principal
Name (Printed): Rafael Benitez Signature: [signature] Date: 9/15/22

II) Facilities/Equipment

2.1 Available Facilities & Equipment

- The description of facilities and hours of accessibility, necessary personnel, equipment, and supplies that are required to design and build the vehicle and payload. Specifically included, what is on hand and what will need to be acquired.

Facilities
The Cedar Falls High School Engineering Room (No. 31) is the main meeting location for the Cedar Falls Rocket Club. The team meets here on a minimum bi-weekly basis to work on current projects. Storage and construction of the vehicle is also performed in this room.
Located nearby, the Cedar Falls Public Library is an after-school meeting place where the team can practice presentations and have work sessions.
The University of Northern Iowa, a local university, also has a library that acts as another meeting place. It has reservable meeting rooms and is open much later into the evening.
Close to the high school, there are soccer practice fields at the University of Northern Iowa. There, the team holds low-power launches for various activities such as educational outreach and the subscale launch (when applicable and permissible).
The ISOAR (Tripoli Iowa Club) launch site in Indianola, IA is the expected site for the subscale vehicle launches whenever the soccer fields at the University of Northern Iowa are unavailable or the flight is higher than the legal limits at the soccer fields.
The Tripoli Minnesota launch site in North Branch, MN is the expected site for launching the team's full-scale vehicle.
Multiple team members are also willing to meet at their houses for meetings after hours if nowhere else is available.

Equipment
The Cedar Falls Engineering Rooms (No. 31 & 30) provide access to a CNC lathe and router, 3D printer, foam cutter, drill press, band saw, laser cutter, and other common hand tools.
The Rocket Club also has its own set of tools available for use. This includes wrench sets, various hand tools, various power tools, and a new 3D Printer.
The team has access to the simulation programs RockSim and OpenRocket. These will be the primary tools in the design of the launch vehicle. Onshape will be the CAD software used by the team to model the launch vehicle and design the payload. Students are provided by the school district with Chromebooks that are capable of running Onshape. The laptops in the

team's meeting room will have OpenRocket and RockSim available for use.

Any equipment used by any member of the team will be under the supervision of an adult educator or team mentor. The team does not believe any other equipment will be needed in the manufacture of the vehicle beyond what the team already owns or has access to. The team's Safety Officer, Jillian Kellum, will supervise all launches, making sure all NAR safety codes are followed. Similarly, the adult educators and team mentor will be overseeing the launch, verifying safety plans are followed as specified in this document, and ensuring safety codes are followed. Prior to entering any facility, or attending any launch, the Safety Officer will brief the team of the safety expectations that members should be aware of and abide by.

III) Safety

3.1 Safety Plan

- A written safety plan addressing the safety of the materials used, facilities involved, and the student responsible for ensuring the plan is followed. This includes an additional risk assessment for all these aspects in addition to proposed mitigations. Identification of risks to the successful completion of the project are also included.

All active members of the CFHS Rocket Club will be properly briefed on hazardous materials and how to properly handle them according to information provided by OSHA and included in our safety data sheets. All facilities nearby these hazardous materials will have safety data sheets available. A risk assessment will be included in the working document (see Appendix II). Members who are working in various facilities will be briefed on the rules and emergency action procedures for the respective facilities. The Safety Officer, team leaders, adult educators, and mentors will be keeping a close eye, making sure appropriate behavior and PPE are being used during the construction and launching of the vehicle and other activities during the course of the project. Mentors and Adult Educators will also be looking for any unintentional safety violations that could result in injury. An injury form will be filled out in any case of injury, no matter how small, in order to prevent the same injury from happening again.

3.2 Procedures for NAR/TRA Personnel, Hazard Recognition, and Material Handling

- A description of the procedures for NAR/TRA personnel to perform. Ensuring compliance with NAR High Power Safety Code Requirements, and the performance of all hazardous materials handling and hazardous operations.

In compliance with the NAR High Power Safety Code requirements, a certified adult team mentor will handle all hazardous materials including motors. During the launch, the adult team mentor, team Safety Officer, and Range Safety Officer will enforce rules to keep anyone present at the launch safe. Team Safety Officer Jillian Kellum has a NAR Level One certification and will handle equipment within the scope of her qualifications.
The team Safety Officer will present safety presentations at the start of all meetings to advise team members on risks and procedures involving hazardous materials and equipment being used at that time. Material Safety Data Sheets and caution statements will be used to warn of hazards and advise on how to handle them. PPE will be available and worn when necessary to protect students while working with hazardous materials or equipment. The adult team mentor and team Safety Officer will enforce all safety guidelines and regulations when handling hazardous material and operations.

3.3 Student Accident Recognition and Avoidance

- A description of the plan for briefing students on hazard recognition and accident avoidance as well as for conducting pre-launch briefings.

Prior to the construction and launch of the vehicle, all team members present will be briefed by the Safety Officer on possible hazards, and measures to prevent or avoid them. This briefing will include general guidelines for the safe use of commonly used machinery. Before each meeting, instructions will be given on how to safely operate and handle specific tools and hazardous materials being used at the time. Personal Protective Equipment (PPE) will be available and worn whenever necessary to keep team members safe from machinery and harmful materials, including fiberglass.

3.4 Description of Safety Plans and Procedures

- A description of the methods to include necessary caution statements in plans, procedures, and other working documents, including the use of proper Personal Protective Equipment (PPE).

Each team member has acknowledged safety risks and agrees to follow established safety procedures by signing a Safety Agreement. This Safety Agreement can be found in Appendix 4. Plans and other related documents will include cautionary statements warning team members of possible hazards during construction or launch. PPE will be available and worn when necessary. Safety rules of any facilities used will be followed. The team Safety Officer, mentor, or adult educators can remove any individual from the site who does not follow the established procedures and rules.

3.5 Plan to Comply with Laws

- The plan for complying with federal, state, and local laws regarding unmanned vehicle launches and motor handling. Specifically regarding the use of airspace, Federal Aviation Regulations 14 CFR, Subchapter F, part 101, Subpart C; Amateur Rockets, Code of Federal Regulation 27 Part 55: Commerce in Explosives; and fire prevention, NFPA 1127 “Code for High Power Rocket Motors.”

Complying with federal, state, and local laws is the top priority alongside team safety. As a result, the Safety Agreement, found in Appendix 4, was created to verify that members have

read the required safety regulations, along with all related safety hazards and laws. The presentations that will be given to the team regarding safety regulations and law compliance are located in Appendix 3. At launch sites, FAA clearances, ceiling heights, and specific regulations will be carefully studied and followed. Compliance with federal, state, and local laws regarding the launch will be done prior to attending the launch. NAR/TRA officials will verify that proper paperwork and permission is gained from a legal standpoint for all launches. Regarding air space, FAR 14 CFR, Subchapter F, Part 101, Subpart C; Amateur Rockets, Code of Federal Regulation 27 part 55: Commerce in Explosives; fire prevention, NFPA 1127 "Code for High Power Rocket Motors," will be specifically followed.

Safety is the number one priority, especially at launch events. Team members will be knowledgeable of the regulations for airspace, high-powered motors, and any other necessary regulations for the launch of high or low-powered vehicles. The Safety Officer specifically will be in charge of monitoring regulations produced by the NAR/TRA alongside any other safety procedures for the launch site. The adult advisors and team mentor will also be at each launch, closely watching and advising the team in case of any potentially unsafe or non-compliant behavior.

3.6 Motor and Energetic Device Safety Plan

- The plan for NAR/TRA mentor purchase, storage, transportation, and use of vehicle motors and energetic devices

Adult Educator Mr. Zeb Nicholson, who has a NAR Level 2 Certification, will be responsible for ordering the vehicle's motors through "Off We Go Rocketry." He will be primarily responsible for the transportation, handling, and storage of the motors. The launch vehicle will be claimed by Mr. Zeb Nicholson, as required by certification procedures. The motor will remain separate from the vehicle during transportation to the launch site, being in compliance with storage and transportation regulations. A Level 2 Certified adult mentor, either Mr. Zeb Nicholson or Mr. Tyler Sorensen, will be in charge of assembling the motor into the launch vehicle. Any other cases of energetic device purchase, transportation, and storage, will be handled by team members or mentors with the relevant certifications.

3.7 Written Statement

- A written statement that all team members understand and will abide by, for the following safety regulations.
    I. Range safety inspections will be conducted on each vehicle before it is flown. Each team member shall comply with the determination of the safety inspection or may be removed from the program.

II. The Range Safety Officer has the final say on all vehicle safety issues. Therefore, the Range Safety Officer has the right to deny the launch of any vehicle for safety reasons.

III. The team mentor is ultimately responsible for the safe flight and recovery of the team's vehicle. Therefore, a team will not fly a vehicle until the mentor has reviewed the design, examined the build, and is satisfied the vehicle meets established amateur rocketry design and safety guidelines.

IV. Any team that does not comply with the safety requirements will not be allowed to launch their vehicle.

All members have signed or will have signed a Safety Agreement (located in Appendix 4) by the PDR deadline that requires them to abide by all safety regulations outlined by the NAR, FAA, NASA Student Launch Handbook, and other various state and federal laws/organizations. Members were made aware that failure to abide by such regulations and rules would result in termination from the team. Additionally, members were made aware to follow the Range Safety Officer's directions, and that the team mentor is responsible for reviewing and ensuring the design, build quality, and safety of the vehicle.

IV) Technical Design

4.1 General Vehicle, Material, and Construction Designs

- General dimensions, preliminary material selection, material justification, and construction methods

The launch vehicle will be 104 inches tall, with a body tube diameter of 5 inches. The team's simulation software, RockSim, predicts the final launch vehicle will have a static stability margin between 2.0, and 3.0, including the motor. Currently, the vehicle's static stability margin is much higher in our simulations, but based on our previous experience the team believes that once the design of the vehicle and payload progress, it will lower. The fin design used will be trapezoidal in shape. The fins will have a 4.5-inch span and 14-inch root length. Not including the motor, the total weight of the vehicle is projected to be 23.5 pounds. All fiberglass that the launch vehicle uses, including the body, fins, and nose cone, will be 0.125 inches thick. Fiberglass was chosen to be the main structural component because of its specific chemical and physical properties. Other various unique parts of the vehicle need to be 3D printed using ABS plastic. A large portion of the manufacturing process for our vehicle will involve cutting fiberglass. This is one of the most hazardous parts of the construction process and without proper PPE can be a serious health risk due to the small particles that can cause skin and respiratory irritation. Rocketpoxy and other high-strength adhesive materials will be used in the assembly of the fins and other parts of the vehicle. For the separation and retention of the different sections of the vehicle, commercially available plastic rivets and shear pins will be used.

There are a variety of reasons why fiberglass is an extremely good choice to use on this vehicle. Corrosive propellants often come in contact with the booster section and fins of the vehicle. Fiberglass' corrosion resistance, high dimensional stability, and high heat resistance makes it perfect for these parts of the vehicle. Fiberglass also has a high strength-to-weight ratio, making our vehicle capable of lifting a potentially heavier payload. Fiberglass is extremely strong regardless of the direction of force due to its directionless grain pattern, which makes the vehicle more durable overall. This is perfect for the vehicle when it is subjected to high speeds, altitudes, and high changes in internal pressure during separation events. These factors make fiberglass a good choice for the recovery section, and nose cone as well. A nice addition to this is the cost-to-benefit ratio of fiberglass. It is affordable for a high school team compared to the much higher expenses of carbon fiber. The team will be getting our fiberglass from Wildman Rocketry. Our team has a history of using this specific fiberglass and the supplier. The fiberglass provided by Wildman Rocketry is readily available, customizable, and very graciously offered at a discount to our team.

4.2 Projected Altitude

- Projected altitude and description of how it was calculated

Using the RockSim simulation software with the K1440 motor from CTI, the apogee of the vehicle is expected to be 4775 feet AGL. SLI requirements give an acceptable range within 3,500 - 5,500 feet AGL, making it within the correct range. The main rail exit velocity requirement is 52 ft/sec, which is achieved with our vehicle's 86.9ft/sec rail exit velocity. This altitude is a very preliminary projection and is most likely subject to change based on the developing payload design. Figure 4.2.1 shows the vehicle modeled in RockSim. The current drag coefficient is at 0.75 and is subject to change due to the current lack of experimental data collection. Performance variability in the vehicle can be found in a few places: the actual drag coefficient, vehicle stability, any changes in air density or mass, and the vehicle's motor thrust variance.

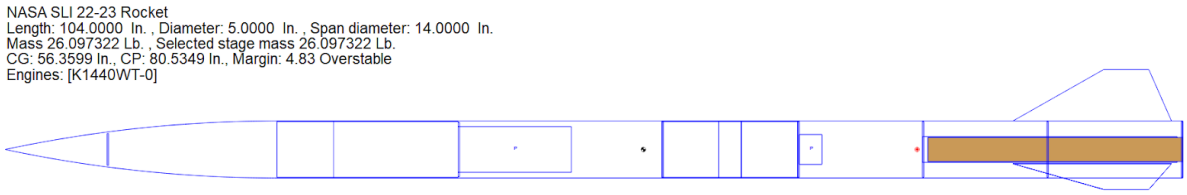


Figure 4.2.1

4.3 Projected Recovery System Design

- Planned recovery system design

The recovery system for our vehicle will be dual-deployment. At apogee, the booster and recovery section will separate, deploying the drogue parachute. Currently, the drogue chute is projected to be a 24-inch, elliptical parachute. A black powder charge will be ignited using the main altimeter to deploy the drogue parachute. A larger backup black powder charge will ignite at one second after apogee with a second altimeter. This redundancy will verify that the vehicle is fully separated and will only slightly affect the total time to landing in the case that the secondary charge is needed. When the vehicle is at 600 ft AGL, the main altimeter will ignite another black powder charge to separate the payload and recovery section of the vehicle. The second altimeter will once again deploy an additional larger black powder charge one second after the first altimeter to verify separation. The main parachute will slow the vehicle down to a much lower rate of descent, ensuring a landing with less than the max allowable 75 ft-lbs of kinetic energy. The black powder charges (FFFFg or 4Fg black powder) will be tested before the subscale and full-scale launches to confirm correct charge sizing. The main chute will be a Fruity Chutes parachute with an approximate diameter of 96 inches. The sizing of

both chutes along with the deployment altitude of the main chute may change to accommodate the 90-second landing time requirement as the payload is finalized.

4.4 Projected Motor Selection

- Projected motor brand and designation

Our team plans to use a Cesaroni K1440 motor on the vehicle this year. It was chosen because it brings the vehicle to a projected altitude of 4,775 ft AGL. Providing a quick, high-thrust take-off at the pad due to its dual-thrust design, this motor gives the vehicle a high rail-exit velocity and a more stable rail exit. The team made the choice to use Cesaroni because it has been previously used for many other successful projects, therefore giving the team confidence in the quality and reliability of the motors.

4.5 Projected Payload

- Detailed description of the team's projected payload

The team would like to propose a payload consisting of a small unmanned aerial vehicle (drone) deployed autonomously after landing. The team will be attempting to complete a few different objectives with this payload. The first objective is to develop and test a method of deploying a device from the launch vehicle in an upright orientation. This technology could aid in the deployment of numerous payloads. Often, experiments onboard high-powered rockets must be contained within the vehicle until recovered and manually extracted. The device the team is proposing could be adapted to various launch vehicles and payloads to allow a greater flexibility and range of possibilities. This device would utilize a motor attached to a threaded rod to drive a sled from a position inside the vehicle to the intended position for payload deployment. Linear motion can be created by rotating the threaded rod while preventing the rotation of the sled assembly, forcing the sled to travel along the length of the rod. The sled assembly will consist of a forward plate, a bed on which to secure the payload, and a rear plate, which will be tethered to the other side of the payload coupler. The deployment system will be secured inside the launch vehicle through the nose cone, and will use a motor and gears to rotate the entire deployment assembly into the vertical orientation before deployment.

The second portion of the payload is utilizing a UAV (drone) to capture images while using GPS locations. The drone will contain a camera, GPS receiver, computer, lidar/ultrasonic sensor, and a battery. A quadcopter design will be used in which upwards thrust is provided by four electric motors with attached propellers. The orientation and flight direction of the drone can be controlled by adjusting the thrust of the four motors. The drone's motor assemblies will fold into the body of the drone prior to deployment, and will be moved into position by springs

and secured with a locking mechanism. The drone will record the GPS location of the vehicle's landing site and will then navigate to the controller of the individual with another GPS. The drone will then lead the operator in the direction of the vehicle using GPS tracking. Using a GPS on the vehicle, drone, and controller, the drone can guide the controller back to the vehicle in the fastest way possible, instead of leaving individuals to search for where the vehicle landed. The drone will operate autonomously and will have an emergency stop or manual takeover in a handheld controller unit. Throughout the drone flight, an onboard camera will capture video and images to document the payload operation. These recordings will assist the team in evaluating the operation of the system during deployment and flight. It will also give an aerial view of the launch vehicle's landing site and configuration. Additionally, the images will be used to showcase the project to the public. Overall, this combined payload will help develop new methods for deploying experiments, improve the ability to recover launch vehicles, and engage members of the public in science and engineering projects.

4.6 Vehicle and Payload Design Requirements

- Addressing the General, Vehicle, Recovery, Payload, and Safety Requirements (Outlined on pages 89-96 of the handbook)

General
Team members (students) are responsible for completing every part of this project from design to the launch of the vehicle and payload. The handling of black powder, electric charges, and electric matches will be done by the team's mentor. The use of past work will be limited and the team understands the penalties that could result from this excessive use. The Critical Design Review deadline will mark when students attending launch week will be listed. These students are required to be actively engaged in the project throughout the entire school year. The team has no foreign national members at this time and will report if any foreign national members join the team before the CDR. The STEM engagement criteria will be met by the plan listed in section 5.1 and will be completed before the FRR due date. The team has various social media accounts including Instagram, Twitter, and Facebook. These accounts will continue to have frequent updates posted to them relating to the status of the team's project and different activities individuals can do. The team acknowledges that there are penalties for late submissions and will complete all submissions on time. These submissions will be in PDF form, including a front page, table of contents, and page numbers. The Cedar Falls High School has a conference room that the team will utilize for video conferencing with the NASA review panel. The conference room is equipped with the necessary technology, which will be tested prior to each video conference with NASA. Tyler Sorensen is our team's mentor this year, and his information can be found in section 1.5. Lastly, our team utilizes a spreadsheet that uses AppScript to track the effort (in hours) put into each milestone of the project.
Vehicle

This year's vehicle will reach a projected apogee of 4775 feet AGL. The altimeter that the team will use this year is identical to last year, the Stratologger CF, which is commercially available. This altimeter has been used by our team for other past Student Launch projects and many flights by the team's adult educators and mentors. In order to turn on the altimeter and its backup on the launch pad, there will be arming switches that will be able to be turned on from the outside of the vehicle, and locked into the "on" position. Each altimeter will have its own dedicated Duracell battery, which was chosen because of its high quality, reliability, and familiarity. The Duracell batteries will be clearly visible in their section, with a bright red casing, easily distinguishable from the other pieces of the payload. The batteries will also be marked as a fire hazard. The vehicle will be designed so that the vehicle can be disassembled and reassembled, to be relaunched, in a minimal amount of time for multiple flights in one day. The igniters that come with the motors that the team purchases will be charged with a twelve-volt battery. The electronics bay and Payload sections of the vehicle are completely independent of each other, utilizing their own battery and electronics systems, to reduce any risk of error. Each device in the electronics bay has an independent battery to reduce the risk of failures. All batteries will be charged with a large enough capacity to last 2 hours powered on with additional time for flight time.

The vehicle will be comprised of three main sections. The first is the booster section which contains the motor, protective wadding, and the drogue parachute. The second section is the recovery section which contains the altimeters, a GPS tracker, the main parachute, protective wadding, and any other equipment necessary for energetic ignition. Most of these parts will be in the electronics bay coupler that stays attached to the recovery section when the booster section separates at apogee. The third section is the payload and nose cone portion of the vehicle. This will include the UAV/drone payload and deployment system, along with any other electronics that control or assist in the deployment of the drone. The nose cone is planned to be metal tipped with non-dense metal to follow the rules defined in the handbook. The nose cone will also have a minimum shoulder length that is 3 inches, greater than ½ of the body tube diameter (5.5 inches). All three sections will be tethered together for the entirety of the flight from launch until touchdown. The current vehicle design does not include a ballast and is highly unlikely to include a ballast in the future. The total ballast weight would not exceed 10 percent of total vehicle weight after burnout if it was needed. At both separation points during the flight, the coupler shoulders will be 10 inches minimum in length, as per the handbook rules, with the payload coupler potentially being longer to accommodate the longer drone payload.

Currently, the team plans to use a Cesaroni K1440 motor to take the vehicle to its apogee of 4775 feet. The solid propellant uses an ammonium perchlorate composite and the motor itself is commercially available. The total impulse of this motor is 2397.6 Ns which does not exceed the 2,560 Ns maximum impulse limit stated in the handbook. As stated in section 4.1, the projected rail exit velocity is 86.9, which is more than the 52.0ft/sec minimum required in the handbook. By the CDR, the team will declare if a motor change is necessary or not. If this is determined after the CDR has passed, a submission that is reviewed by the NASA Range Safety Officer will be needed. An Aeropack retainer will be used to hold the motor, avoiding a friction fit style mounting method. At any point during the flight, the vehicle will not pass Mach 1. The motor increases the weight near the bottom of the vehicle but is soon after

reduced due to motor burnout. Using only one motor, there will be no forward canards, forward-firing motors, hybrid motors, or motor clusters on the vehicle.

The vehicle will be designed to accommodate either the 8-foot 1010 rail or the 12-foot 1515 rail launch rail specifications stated in the handbook. The team will also abide by the launch preparation rules stated in the handbook, with the vehicle being ready for launch within two hours of initial preparations. RockSim calculations project the static stability of the vehicle is 4.83 calibers (the distance between the center of pressure and center of gravity).

For the subscale vehicle, a mock payload weight will be put into the vehicle proportional to the actual payload weight. The subscale vehicle will be launched before January 9, 2023, powered by an H or I-class motor, yet to be determined at a later date. This should give a satisfactory representation of the full-scale vehicle's proportional capabilities and flight stability. The altimeter used in the subscale vehicle will be identical to the altimeter used in the full-scale flight, the Stratologger CF. The subscale vehicle will be a newly constructed vehicle to accommodate the requirements of this year's project and the different sizing of the vehicle compared to previous vehicles. The flight data provided by the altimeter will be submitted in the CDR report as proof of flight.

Regarding the full-scale vehicle, the vehicle launched for the vehicle demonstration flight will be the same as the one flown on launch day to ensure the recovery systems, structural integrity, and stability demonstrated prior are identical. This will also verify the team’s capability to prepare and launch the vehicle for the flight. The vehicle demonstration flight will show that the payload, vehicle, and recovery systems all function as they were designed to. This vehicle will be constructed completely and fully by student team members this school year. The launch vehicle and its related components will not be modified without the explicit permission of the NASA RSO after the full-scale demonstration flight, as per the handbook regulations. The FRR report will have altimeter data provided that is proof of the successful full-scale demonstration flight. The latest that the vehicle will have been constructed and flown by is March 6, 2023. The team’s name and contact information will be clearly visible on each piece of the launch vehicle. The team is still deciding if they will be using an additional side-mounted camera on the vehicle. This will be a very minimal protuberance that should not affect the overall flight at all.

Recovery (Electronics Bay)

The recovery process of the vehicle begins at apogee with the 24-inch drogue chute being deployed. This allows the vehicle to descend at a faster rate until the main 96-inch parachute is deployed at ~600 ft AGL. This will slow the vehicle down even further until landing. The dual redundancy of this system is labeled in section 4.3. Ground ejection tests and electronic testing for the sub-scale and full-scale vehicles will be completed with enough time prior to all launch events to account for any potential error that may occur if the testing fails. This testing includes proper parachute deployment of both the main and drogue chute and black powder charge testing, making sure that damage does not occur to the vehicle. The handbook requirement of the final landing kinetic energy being 75 ft-lbs or less will be followed. As stated in the vehicle section above, the batteries in the recovery/electronics bay section are completely independent of any other batteries on the vehicle and there is one separate battery

per component (altimeter, backup altimeter, and GPS tracker).
The team intends on using electronically controlled charges, powered with their own independent batteries. The motor ejection will not be used to deploy the parachutes unless as a tertiary backup. The vehicle will land within the 2500-foot recovery zone in ~57 seconds after main chute deployment. This falls within the zone requirements and 90-second descent time requirements in the handbook. Electronic devices will be checked on launch day for functionality, as well as prior to launch day. Only one tracking device is needed for the vehicle, as it is only one tethered-together section. The Featherweight GPS tracker is the tracker being used that is commercially available from Off We Go Rocketry. The launch vehicle will have radio transmitting devices on board, which will require specific signal interference mitigation to be applied to the vehicle. Recovery devices will have no adverse effects due to the distance and signal separation from the payload section.
Payload
Energetics will not be used in any case for the payload portion of the vehicle. All FAA and NAR rules and regulations will be followed regarding the payload's design. The team is paying very close attention to the FAA's rules, especially those relating to drones, to have 100% confidence in the legality of our mission. This includes the FAA's special rule for model aircraft (Public Law 112-95 Section 336). If our drone weighs more than 0.55 lbs, our team will register the drone with the FAA and the registration number will be visibly marked on the vehicle. Our payload will not be jettisoned during the recovery phase of flight and no other parts will be jettisoned from the vehicle at any point during the flight. Only after landing will the drone deploy from the vehicle.
Safety
The team Safety Officer is Jillian Kellum, who is responsible for the safety of team members as the team works on the vehicle. She will be involved in almost every activity that the team is involved in. This includes design, construction, and assembly of the vehicle and payload, along with all testing and launches including ground testing, sub-scale launch tests, full-scale launch tests, competition launch, and recovery. As different stages of vehicle and payload design, construction, and assembly progress, Jillian will give safety presentations to set safety requirements and expectations for all team members. A different safety presentation will be given for launch tests and launch days. A spreadsheet will also be created listing all MSDS/chemical inventory that the team currently has which will be updated when any inventory is used.
A launch and safety checklist will be made for every launch the team is involved in relating to NASA. There will also be guidelines that the team creates to ensure the safety of the team in the construction, assembly, launch, and recovery of the vehicle. All rules and regulations put forward by the local rocket club's RSO will be followed. All rules and regulations required by the FAA to ensure team safety will also be followed.

4.7 Technical Challenges and Solutions

- Addressing major technical challenges and solutions

One major technical challenge in implementing the payload will be the drone size itself. Since the payload releases a drone upon landing, the drone will need to fit in a small < 5-inch cylindrical space. Due to these specific dimensions, a custom drone would need to be designed and manufactured by the team, as no commercial drone can currently fit/fold up into the necessary dimensions while maintaining the level of technology that is required. With this limited available space for the drone, it will need to have wings that fold in and out, as well as limited mechanical and computer components. A custom retention system will also need to be created in the payload section to ensure the drone remains secure during flight and landing, so it does not damage either the vehicle or itself.
Another major technical challenge that presents itself relating to the drone would be its deployment upon the landing of the vehicle. Before deployment of the drone commences, the autonomous deployment program must confirm that the vehicle is safely on the ground and is not moving, or this has to be confirmed by a person with a line of sight to the vehicle. To do this, a program could take the change in velocity over ten seconds for the vehicle and if that number is 0, initiation of the deployment program will commence. After this, other obstacles relating to drone deployment include vehicle separation upon landing to open and allow the drone to take off. The drone separation from the vehicle on the ground will also be dependent on this commencement initiation, and the separation will have to be mechanically initiated on the ground, as the drone needs to stay secure and locked during flight to prevent premature separation. After ground separation has occurred the wings and propellers open/initiate which allows the drone to take off and begin its part of the mission.

V) Stem Engagement

5.1 Stem Engagement Plan and Evaluation Criteria

- Plans and evaluation criteria for required STEM engagement activities. (See Project requirement 1.4 on page 89)

To reach and exceed the required 250 participants engaged in direct, educational STEM outreach, the team will work with local schools and youth organizations to engage them in educational lessons about STEM, as well as hands-on activities to inspire the future generation. The team will communicate with the administration of said schools and organizations to build on current material and demonstrate applicable activities to connect their learning with rocketry.
In previous years, the team has worked with elementary schools, junior highs, Boy Scout troops, Cub Scout packs, and Girl Scout troops. Working with Scout troops has extended the team's outreach from one school district to students across Iowa. In addition to these connections, the team plans to reach out to local 4H groups, the Boys and Girls Club of the Cedar Valley, and the University of Northern Iowa Expanding Your Horizons Group.

VI) Project Plan

6.1 Development Timeline

- A detailed development schedule/timeline or work breakdown structure (WBS) covering all aspects necessary to complete the project successfully.

Following proposal acceptance, the Cedar Falls Rocket club will meet Tuesdays and Thursdays in a large group setting in order to discuss mid-term goals, clerical necessities, and presentation of subgroup progress. After large group discussion, subgroup meetings will occur, focusing on short-term deadlines and problem-solving current work. The subgroup leads will keep members on schedule and will update the Team Lead on current progress. The Team Lead will meet bi-weekly with subgroup leads and each other to discuss hard deadlines and overall group expectations.

6.2 Budget

- A detailed budget to cover all aspects necessary to complete the project successfully, including team travel to the launch.

Total Budget: **$10,166.35 + $2,033.27 = $12,199.62**
The team will be budgeting $773.78 for motors this year (including hazmat charges). The Cesaroni K1440 Motor will be used for full-scale launches, and have budgeted for 3 of these motors. While only two are needed (one for the full-scale test launch and one for the final Huntsville launch), three will be bought in case a relaunch is needed for any reason. In addition, $50 will be budgeted for the subscale launch motor(s).
$5,084.64 will be budgeted for travel. The team plans to use 6 hotel rooms for 4 nights during the Huntsville trip. With a typical hotel rate of $142.00 per night, the budget for hotels will be $3,408.00. For travel to Huntsville, the team expects to use three vans, requiring 50 gallons of fuel per van in each direction, for a total of 300 gallons. Assuming a price of $3.50 per gallon, $1,050.00 will be budgeted for travel costs to Huntsville. Additionally, the team is planning to travel to North Branch, MN for demonstration flights. Assuming 14 gallons per van per direction, $294.00 will be included for travel to North Branch. Altogether, the travel costs are $4,752.00, and with a 7% tax, the total budget for travel is $5,084.64.
$500 will be budgeted for the scale model this year. Since the scale model will not be utilizing the same quality of materials (ex. Bluetube as opposed to fiberglass) and the payload will be simulated with mass, the cost will be less. This cost includes the body tubes, fins, simulated payload mass, shock cord, and any other necessary materials.

The team is budgeting $5,081.71 in materials for the final launch vehicle (see figure 6.2.2). This amount is due to the current cost of materials such as fiberglass body tubes, nose cones, and fins. The most substantial items include the parachute and vehicle tracker transmitters and receivers.

The team's itemized budget plus estimated travel expenses total is $10,166.35. An additional 20% of all expenses have been added on as a part of the team's safety plan in order to cover unpredictable events such as broken parts, travel expenses, extra items, etc, adding up to a total of $12,199.62. The team plans to continue to fundraise through $14,000 in order to build up funds for the following year, as well as for other concurrent projects written in the sustainability plan for this year.

2023 NSL Budget - Travel					
Hotel:	**Cost per room**	**Number of Rooms**	**Number of nights**		**Total Cost**
Home2 Suites by Hilton	$142.00	6	4		$3,408.00
Gas:	**Cost per Gallon**	**Number of gallons for one-way trip**	**Number of Vehicles**	**Trips**	**Total Cost**
	$3.50	14	3	2	$294.00
Gas:	**Cost per Gallon**	**Number of gallons for one-way trip**	**Number of Vehicles**	**Trips**	**Total Cost**
	$3.50	50	3	2	$1,050.00
Travel Tax:	**$332.64**		**Total Travel Budget:**		**$5,084.64**

Figure 6.2.1: Travel Budget

2023 NSL Budget - Materials

Item:	Cost:	Quantity:	Total Cost:
Motors & ESCs (comes in pack of 4)	$45.00	1	$45.00
Propellers	$15.00	4	$60.00
Microcontroller	$25.00	2	$50.00
Radio (for Remote Override) (Custom Built)	$100.00	1	$100.00
GPS Module	$18.00	1	$18.00
Altimeter	$16.00	1	$16.00
Gyro	$30.00	1	$30.00
Battery	$45.00	2	$90.00
Camera	$150.00	1	$150.00

Lidar/Ultrasonic	$26.00	1	$26.00
Exterior/Interior Cameras	$150.00	3	$450.00
Cesaroni K1440 Motor	$196.26	3	$588.78
5" Fiberglass body tube (per ft)	$46.25	7	$323.75
Cesaroni 54mm 6-Grain Hardware Set	$135.00	1	$135.00
5:1 Ogive Filament Wound Fiberglass 5" nosecone	$150.00	1	$150.00
96" Parachute	$382.97	2	$765.94
24" Drogue Parachute	$79.23	2	$158.46
5" Fiberglass body tube coupler	$47.41	2	$94.82
RocketPoxy structural adhesive	$65.00	1	$65.00
G10 Fiberglass 12"x12"x0.125" sheet (for fins)	$18.00	3	$54.00
Kevlar Shock Cord - 1500#- Main Chute (per ft.)	$0.97	40	$38.80
Kevlar Shock Cord - 1500#- Drogue Chute (per ft.)	$0.97	40	$38.80
Tube Bulkhead - 5"	$7.99	4	$31.96
3/8" U-bolts	$5.49	4	$21.96
Motor Mount Tubing - 54mm fiberglass	$27.00	1	$27.00
Centering Ring - 5" x 54mm inner dia. Fiberglass	$10.00	4	$40.00
AeroPack Retainer - 54mm	$31.03	1	$31.03
1/4" quick links	$0.99	6	$5.94
4-40 Nylon shear pins (20-pack)	$1.00	6	$6.00
Removable Plastic Rivets (10-pack)	$5.00	5	$25.00
1/4" threaded steel rod (3ft. each)	$1.75	2	$3.50
PerfectFlight StrattologgerCF altimeter	$54.95	2	$109.90
Scale Model	$500.00	1	$500.00
Cesaroni Motor for Scale Model	$50.00	1	$50.00
Vehicle Tracker Transmitter	$150.00	1	$150.00
Vehicle Tracker Receiver	$190.00	1	$190.00
1/4" threaded steel rod (3ft. each)	$1.75	1	$1.75
12V DC Stepper Motor	$13.99	1	$13.99
Deluxe Servo	$15.99	2	$31.98
Coupler Bulkhead - 5"	$11.50	3	$34.50
4" Fiberglass Body Tube (per ft.)	$26.40	1	$26.40

Tax:	$332.45
Total Material Budget:	**$5,081.71**

Figure 6.2.2: Material Budget

6.3 Funding Plan

- A detailed funding plan

The team's funding plan includes a combination of "work for donations," small business contributions, and large company sponsorships. The "work for donation" opportunities include manning parking lots and concession stands for the local university's athletic events and bussing tables at restaurants such as Pizza Ranch whilst collecting donations. Small business contributions will come through the efforts of the students going door to door on Main Street and throughout the community, educating small business owners and neighbors alike on the NASA project and how their money will be used. Large company sponsorships, such as John Deere, will also be pursued but are not necessary to meet the team's budget. Additionally, the team will utilize the previous year's "surplus funds" to cover any initial costs incurred at the beginning of the year.

6.4 Local Sustainability Plan

- A clear plan for sustainability of the rocket project in the local area. Includes how to provide and maintain established partnerships and regularly engages successive classes of students in rocketry. It should also include partners (industry/community), recruitment of team members, funding sustainability, and STEM engagement activities.

The team's sustainability plan for the club includes word of mouth, posters, outreach events, and social media. Examples of outreach activities may include presentations and activities, such as launching paper rockets with local boy and girl scout troops, as well as elementary students. Several informational presentations are held at the beginning of the year, growing significantly from year to year with each success the club has brought. The Cedar Falls Rocket Club attracts students from all fields, ranging from art to computer science to business. The club utilizes every skill a student brings with them, as the team knows the more perspectives included, the better the team will become.

Other members of our club will also be competing in The American Rocketry Competition (TARC). This project will give them experience and better prepare them to contribute to projects for NASA SLI in the future.

Additionally, our club members will also be competing in Rockets for Schools (RFS), another qualifying competition for NASA SLI. This project will again give members experience and prepare them for NASA SLI in the future.

Appendix I) Project Calendar

September 2022

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
				1 Team meeting	2	3
4	5	6 Team meeting	7 Decide Project Idea	8 Team meeting	9 Proposal Work	10 Proposal Work
11 Proposal Work	12 Proposal Work	13 Team meeting	14 Proposal Work	15 Team meeting	16 Proposal revisions	17 Proposal Work
18 Proposal Work	19 **Submit Proposal by 8 a.m. CST.**	20 Team meeting	21	22 Team meeting	23	24
25	26	27 Team meeting	28	29 Team meeting	30	

October 2022

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
						1
2	3	4 Team meeting, Awarded proposals announced	5	6 Team meeting Kickoff and PDR Q&A	7	8
9	10	11 Team meeting,	12	13 Team meeting	14	15 Outreach event dates

		start ordering materials				scheduled
16	17	18 Team meeting	19 Sections I-III of PDR completed	20 Team meeting **Social media handle list sent to project office by 8 a.m CDT.**	21	22
23	24 Sections IV-VI of PDR completed	25 Team meeting	26 **PDR DUE at 8 a.m. CDT**	27 Team meeting PDR revisions, PDR presentation completed	28	29
30 PDR completed and submitted	31					

November 2022

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
		1 PDR Video Teleconfer-ences begin and Team meeting	2	3 Team meeting	4	5
6	7	8	9	10	11	12

		Team meeting		Team meeting		
13	14	15 Team meeting	16	17 Team meeting	18	19
20	21 PDR Video Teleconfer-ences end	22 Team meeting	23	24	25	26
27	28	29 Team meeting	30			

December 2022

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
				1 CDR Q&A	2	3
4	5	6 Team meeting	7	8 Team meeting	9	10
11	12	13 Team meeting	14	15 Team Meeting	16	17
18	19	20 Team meeting	21	22	23	24
25	26	27	28	29 CDR Work Time	30 CDR Work Time	31

January 2023

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*

1	2 CDR Work Time	3	4	5 Team meeting and Check over CDR and make final edits	6	7 CDR Work Time
8 CDR Proofread and Submitted	*9* **Subscale Flight deadline** **Submit CDR, presentation slides, and flysheet report by 8am**	10 Team meeting	11	12 Team meeting	13	14
15	16	17 Team meeting	18	19 Team meeting	20	21
22	23	24 Team meeting	25	26 Team meeting	27	28
29	30	31 Team meeting				

February 2023

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
			1	2 Team Meeting	3	4
5	6	7	8	9	10	11

		Team meeting		Team meeting *and* FRR Q&A		
12	13	14 Team meeting	15	16 Team meeting Sections V-VII of FRR completed	17	18 Full scale launch completed
19	20	21 Team meeting FRR presentation complete	22	23 Team meeting	24	25 FRR Work Time
26	27 Outreach interactions completed by now	28 Team Meeting				

March 2023

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
			1	2 Team Meeting	3	4 FRR Work Time
5 Check over FRR presentation and report	6 **Vehicle Demonstrati-on Flight deadline** ***and*** **Flight Readiness Review (FRR)**	7 Team meeting	8	9 Team meeting	10	11

	report, presentation slides, and flysheet submitted to NASA project management team by 8:00 a.m. CST.					
12 FRR video teleconfere n-ces **start**	13	14 Team meeting	15	16 Team meeting	17	18
19	20	21 Team meeting	22	23 Team meeting	24	25
26	27	28 Team meeting	29	30 Team meeting	31 FRR video teleconfere n-ces **end**	

April 2023

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
						1 Launch window opens for teams not traveling to Launch Week. PLAR must be

						submitted within 14 days of Launch.
2	3 **Payload Demonstration Flight and Vehicle Demonstrati-on Re-flight deadlines, *and* FRR Addendum submitted to NASA project management team by 8:00 a.m CDT.** (Teams completing additional Payload Demonstration Flights and Vehicle Demonstrati-on Re-flights only)	4 Team meeting	5	6 Launch Week Q&A Team meeting	7	8
9	10	11 Team meeting	12 Teams travel to Huntsville, AL,	13 Official Launch Week Kickoff,	14 Launch Week activities	15 Launch Day and Awards Ceremony

			Launch Readiness Review (LRR) for teams arriving early	LRRs, Launch Week activities		
16 Backup Launch Day	17	18 Team meeting	19	20 Team meeting	21	22
23	24	25 Team meeting	26	27 Team meeting	28	29
30 Launch window closes for teams not traveling to Launch Week. PLAR must be submitted within 14 days of launch.						

May 2023

Sunday	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*	*Saturday*
	1 **Teams travelling to Launch Week: Post-Launch Assessment Review**	2	3	4	5	6

	(PLAR) submitted to the NASA project management team by 8:00 a.m. CDT					
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Appendix II) Risk Assessment

Risk:	Causes:	Risk Level:	Mitigation:
Power Tool Usage	Improper usage of equipment, lack of PPE, and lack of alertness.	Medium	All members will be briefed on how to use appropriate power tools and demonstrate knowledge of the correct use of them to a supervisor. Members will be informed to wear the appropriate PPE at all times while power tools are in use. Members who exhibit fatigue or feel tired will not be permitted to operate power tools at the given time.
Hand Tool Usage	Improper usage of equipment, lack of PPE, and lack of alertness.	Low	All members will be briefed on how to use appropriate hand tools and demonstrate knowledge of the correct use of them to a supervisor. Members will be informed to wear the appropriate PPE at all times while hand tools are in use. Members who exhibit fatigue or feel tired will not be permitted to operate hand tools at the given time.
Hazardous Chemical/Material Usage/Handling	Improper handling/use of materials/chemical(s),	High	All members will be briefed on the correct use and handling of

	lack of PPE.		any hazardous materials/chemicals. If applicable, only designated/certified individuals will handle the materials/chemicals in question. Additionally, members will be briefed and required to wear all necessary PPE while handling/using any hazardous materials/chemicals
Soldering Fumes/Injury	Improper handling of soldering equipment, lack of PPE, poor ventilation.	Medium	All members will be briefed on the correct use and handling of soldering equipment, and how to mitigate the effect of the fumes. Only members who can demonstrate knowledge and correct usage of soldering equipment/tools will be permitted to operate them. In addition, all members performing soldering will be wearing the proper PPE, as designated by the Safety Officer prior to starting. Furthermore, soldering will only take place in a well ventilated area to mitigate the effects of the fumes produced.
Uncured Epoxy	Improper handling of	Low	All members will be

Usage	Epoxy, improper clean-up of Epoxy.		briefed on the correct use and handling of Epoxy prior to use. Proper PPE will be worn as needed, as directed by the Safety Officer prior to starting. Members will also be briefed on the correct cleanup of Epoxy, both personally (such as on skin) and in the workspace, and will be required to do such.
Sanding Fiberglass	Lack of PPE, poor ventilation.	High	Members will be briefed on the correct and safe usage of how to sand fiberglass and the equipment needed in doing so. They will also be advised and required to wear the proper PPE, as directed by the Safety Officer. Due to the particles emitted during the sanding of fiberglass, this will only take place in a well-ventilated area where the dust and its effects can be dispersed.
Cold Weather Launching Conditions	Improper cold weather clothing and garments.	Medium	Prior to any launch, especially those performed in cold weather, members will be briefed on what launching conditions look like as well as reminded

			to wear the proper clothing for the launch. If the launch weather is colder, members will be reminded to wear gloves, hats, jackets, base layers, warm pants, warm socks, and shoes/boots.

Appendix III) Safety Presentations (Construction and Launch)

Rules for Safe Launching and Construction

2022-2023

Accident prevention- your number one intention

Certification

Only handle/possess/launch rocket motors and/or rockets within your certification and required licensing.

Materials

Only use light weight materials for the construction of the rocket

- Paper
- Plastic
- Wood
- Rubber
- Fiberglass
- Necessary ductile metal

Motors

Only use certified, commercially made rocket motors

DO NOT tamper with these motors or use them for any other purposes except those recommended by the manufacturer.

DO NOT allow smoking, heat sources, or open flames within 25 feet of these motors.

Ignition System

One will only launch with an electrical launch system and electrical motor igniters

Igniters must be installed on launch pad

Launch system must have safety interlock in series with the launch switch, and launch switch must be returned to off after ignition

Misfires

If the rocket does not launch after the press of the electrical launch system, remove the launcher's safety interlock or disconnect its battery and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

Launch Safety

Use a five second countdown before launch. The safety officer will ensure that there is a means available to warn participants and spectators in the event of a problem, and ensure everyone is farther than what is written in the Minimum Distance Table.

Launch Safety

When arming onboard energetics and firing circuits, the safety officer will ensure no person is at the pad except the required personnel. Stability will be checked and will not fly is unstable. Observation of the requirements of NFPA 1127 will be made when necessary.

Launcher

Rocket must be launched from a device that provides rigid guidance until it reaches a speed that ensures stable flight, and it within 20 degrees of vertical

If windy rocket must be launched away from spectators

Blast deflector must be used to protect ground, and debris must be cleared from around launch pad

Size

Rocket must not contain any combination of motors with more than a total of 40,960 N-sec

Rocket must not weigh more than ⅓ the average thrust of the motor being used

Flight Safety

Rocket must not be launched at a target, into clouds, near airplanes, or on a trajectory that takes it above spectators or outside of the bounds of the launch site, or with any flammable or explosive payloads

Rocket must not be launched when wind speed exceeds 20 mph

One must comply with FAA rules and regulations, and make sure rocket does not exceed approved ceiling

Launch Site

- Rocket must be launched outdoors, in an area free of trees, power lines, occupied buildings, and without persons not involved in the launch
- Open area must have a minimum diameter of half the launch ceiling, or 1500 ft

Launcher Location

- Launcher must be 1500 ft from any occupied building or public highway with traffic heavier than 10 vehicles per hour
- Must not be closer to launch site than minimum distance allowed (200 ft)

Recovery System

- A recovery system where all parts of the rocket return safely and undamaged in a way in which they can be flown again must be used
- Only flame resistant or fireproof materials may be used in recovery system

Recovery Safely

- One must not attempt to recover rocket from power lines, tall trees, or other dangerous places
- One must fly it under conditions where it not likely to land in spectator areas or outside of launch boundaries
- One may not attempt to catch a rocket on its descent

Construction

Motor Handling

Only Jillian is allowed to handle level one certified motors

Handling wood

- Sand to avoid splinters
- When sanding, wear proper PPE in order to prevent injuring oneself due to splinters

Handling Fiberglass

- Fiberglass will also gives splinters
- Wear gloves when handling
- Wear a mask when sanding to avoid breathing in fiberglass splinters

Soldering

Only solder in a well ventilated area to avoid inhaling fumes

Be careful not to burn yourself with soldering iron or solder

Handling Electronics

Be careful not to electrocute yourself

Do not touch exposed wires

Do not work on anything connected to a power source

Handling Chemicals

Always wear appropriate PPE (gloves, glasses, closed toed shoes, etc)

Know proper spill or skin contact responses and where safety shower stations are located

Avoid all contact with skin or eyes, and do no ingest any materials used in rocket construction

Handling Epoxies and Adhesives

The epoxies used in construction can be dangerous

Avoid contact with skin, hair, and clothes

Handling Hand Tools

Always wear proper PPE

Always have the proper training before operation of hand tools and/or certified adult present

Handling Power Tool

Do not use any tool you have not had prior training for

Always wear proper PPE

Some tools may only be used by team leads or adult mentors

Appendix IV) Safety Agreement

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I _____(Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

_____

Participant's Name (First and Last - Printed)

_____ _____

Participant' Signature Date

_____

Team Leader Name (First and Last - Printed)

_____ _____

Team Leader Signature Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Ethan Strohm (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Ethan Strohm
Participant's Name (First and Last - Printed)

Ethan Strohm
Participant' Signature

9 Sept. 22
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Team Leader Signature

9/17/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Carson Anton (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Carson Anton

Participant's Name (First and Last - Printed)

Participant' Signature

9/09/2022

Date

Torin Brown

Team Leader Name (First and Last - Printed)

Team Leader Signature

9/17/2022

Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Sean Radke (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Sean Radke
Participant's Name (First and Last - Printed)

Sean Radke
Participant' Signature

9/9/22
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Torin Brown
Team Leader Signature

9/17/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Anna Scannell (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Anna Scannell
Participant's Name (First and Last - Printed)

Anna Scannell
Participant' Signature

9/17/22
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Torin Brown
Team Leader Signature

9/17/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Torin Brown (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Torin Brown
Participant's Name (First and Last - Printed)

Torin Brown
Participant' Signature

9/11/2022
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Torin Brown
Team Leader Signature

9/11/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Grant Redfern (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Grant Redfern
Participant's Name (First and Last - Printed)

Participant' Signature

9/12/22
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Team Leader Signature

9/16/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Jack Schwestka (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Jack Schwestka
Participant's Name (First and Last - Printed)

Jack Schwestka
Participant' Signature

9/11/22
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Torin Brown
Team Leader Signature

9/16/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Carson Wirtz (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Carson Wirtz
Participant's Name (First and Last - Printed)

Participant' Signature

9/12/2022
Date

Torin Braun
Team Leader Name (First and Last - Printed)

Team Leader Signature

9/16/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Mila Haynes (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Mila Haynes

Participant's Name (First and Last - Printed)

MH

Participant' Signature

09-17-22

Date

Torin Brown

Team Leader Name (First and Last - Printed)

Torin Brown

Team Leader Signature

9/17/2022

Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Elliot Purdum (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Elliot Purdum
Participant's Name (First and Last - Printed)

Elliot Purdum
Participant' Signature

9/17/22
Date

Tom Brown
Team Leader Name (First and Last - Printed)

Tom Brown
Team Leader Signature

9/17/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Jillian Kellum (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Jillian Kellum
Participant's Name (First and Last - Printed)

Participant' Signature

09/09/2022
Date

Tarin Brown
Team Leader Name (First and Last - Printed)

Team Leader Signature

09/12/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Ava Mallaro (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Ava Mallaro
Participant's Name (First and Last - Printed)

Ava Mallaro
Participant' Signature

09/9/2022
Date

Tonin Brown
Team Leader Name (First and Last - Printed)

Tonin Brown
Team Leader Signature

09/9/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Becca Nicholson (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Becca Nicholson
Participant's Name (First and Last - Printed)

Participant' Signature

09/15
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Team Leader Signature

9/16/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Keenan Williams (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Keenan Williams
Participant's Name (First and Last - Printed)

Keenan Williams
Participant' Signature

9/16/22
Date

Tori Brown
Team Leader Name (First and Last - Printed)

Tori Brown
Team Leader Signature

9/16/2022
Date

NASA Student Launch 2023

Cedar Falls High School Rocket Club

Safety Agreement

By signing this document, I Cale Wellnitz (Name - First and Last) agree to abide by laws, regulations, safety standards, and procedural guidelines relating to high powered rocketry stated in the National Association of Rocketry Handbook and safety code, The Federal Aviation Administration's state and federal laws, National Fire Protection Association, all Environment and Safety laws in the location where launches take place, and any Material Safety Data Sheets for all materials used in the design and completion of the Cedar Falls Rocket Clubs entry to any NASA Student Launch (NSL) events or competitions. I understand the regulations specific to the launch site will be followed and I will listen to the Range Safety Officers' command. Additionally, I agree the team mentor will review the design, build quality, and safety of the rocket, making sure the rocket complies with rocketry design and safety guidelines. If not, our team will not be able to launch a rocket. I agree to follow the minimum distance tables when launching rockets in each location for any purpose relating to the NSL competition. I agree to abide by any commands, rules, and procedures outlined by the Cedar Falls Rocket Clubs' Safety Officer, Team Leaders, and Adult Educators when working in the workspace, or during any team-related launch. I agree, if I do not follow all safety guidelines, my role on this team will be terminated as well as all relation to NSL.

Cale Wellnitz
Participant's Name (First and Last - Printed)

Participant' Signature

9/11/2022
Date

Torin Brown
Team Leader Name (First and Last - Printed)

Team Leader Signature

9/15/2022
Date