2019 First Nation Launch

Flight Readiness Report

For Wisconsin Space Grant Consortium

University of California, Los Angeles
4-1-2019

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1 Team Information

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NAR/TRA Certification:	Level 3

2 Summary of Flight Readiness Report

2.1 Launch Vehicle Summary

Vehicle Dimensions and Mass

The launch vehicle this year is designed to accommodate the payload necessary to complete this year's challenge. The design is focused on providing enough internal space for the avionics bay as that is where the electronics needed for the challenge are located. The other sections of the rocket not focused on providing space for the avionics bay were designed to be light and strong, provide space for the recovery systems, and accommodate for additional necessities not foreseen early in the design process, such as adding in masses to guarantee a lower descent time. The details of the design, such as dimensions and mass of the launch vehicle, are detailed below.

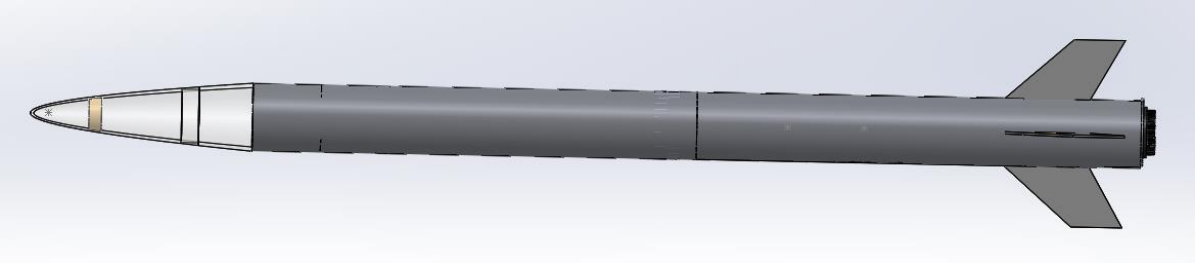

Figure 2.1.1: SolidWorks Model of Rocket Structure

Table 2.1.1: Part Materials and Dimensions

Part	Material	Dimensions	
Upper and Lower Body Tube	Carbon Fiber	Inner Diameter	3.879''
		Wall Thickness	0.038''
		Length	26''
Nosecone	3D-Printed PLA/ABS	Shoulder	3.879''
		Wall Thickness	0.222''

		Length	13’’
Fins	Fiberglass	Thickness	0.134’’
Coupler	Carbon Fiber	Outer Diameter	3.879’’
		Wall Thickness	0.060’’
		Length	7.8’’
Fin Securing Mechanism	Pine	Outer Diameter	3.8395’’
		Thickness	0.7610’’
		Slits	0.1545’’ x 0.46’’
Top Centering Ring w/ Rods Attached	Pine	Outer Diameter	3.8475’’
		Inner Diameter	2.2945’’
		Thickness	0.7610’’
Bottom Centering Ring	Pine	Outer Diameter	3.8495’’
		Inner Diameter	2.2750’’
		Thickness	0.7585’’
Locking Mechanism	Pine	Outer Diameter	3.8470’’
		Thickness	1.5145’’
Top Bulkhead	Pine	Outer Diameter	3.879’’
		Thickness	0.748’’
Nosecone Bulkhead	Pine	Small Diameter	1.772’’

		Large Diameter	1.972’’
		Thickness	0.7320’’

Figure 2.1.2: Cross Section Side View of Rocket with CP and CG indicated

Table 2.1.2: Rocket Specifications

Specifications	
Total Length	65.915’’
Center of Pressure (from the tip of the nosecone)	47.707’’
Center of Gravity (from the tip of the nosecone)	42.283’’
Stability Margin	1.12
Total Mass	10.4375 lb
Mass w/o Motor	7.75 lb

Motor Selection

The motor for this year, the Aerotech J450DM, was selected by our team between the two choices of motors given by the competition. We selected this motor based on flight time. While using this motor, our descent time is already very near the maximum of 90 seconds so using the more powerful K motor would extend an already long flight time. The specifications of this motor are listed in Table 2.1.3 below.

Table 2.1.3: AEROTECH 54mm HP SU DMS MOTOR - J450DM - 14A Specifications

Size: 54mm Single Use	**Motor Length:** 358 mm
Delay: 14 sec	**Max Thrust:** 125.0 Newtons
Burn Time: 2.4 sec	**Total Mass:** 1209.0 g
Total Impulse: 1097.0 Newton-seconds	**Propellant Mass:** 662.0 g
Thrust to Weight ratio: 10.550	

Target Altitude

The target altitude is 4041 feet, which was given from the rocket simulation software OpenRocket. To get the most accurate value, the parameters we used specified the location of the launch, Richard Bong State Recreation Area; the assumed wind speed for the launch date, which is around 12 mph; and the launch rod length, 6 ft.

Recovery System

Currently, our main method of decelerating the rocket to a safe landing speed is through a drogue chute deployed at apogee and the main chute deployed at 500 feet.

The drogue chute that we have chosen is 21.5 inches in diameter, has a drag coefficient of 0.80, and is made of ripstop nylon. It has 6 shroud lines made of round elastic cord, each about 11.811 inches in length. This drogue chute will be attached to the rocket through use of a shock cord that is 25 feet in length and 3 quicklinks. It will be protected from any ejection charges or explosions using a firecloth.

The main chute has a diameter of 60 inches, has a drag coefficient of 0.80, and is made of ripstop nylon (same as the drogue chute). It also has 16 shroud lines which are each 54 inches in length. It will be attached to the rocket and the nosecone through use of a 28.05 ft shock cord, 3 quick links, and a firecloth to protect it from any ejection charges.

Rail Button Size

We will be using 1-inch rail buttons to ensure that we have adequate spacing between the rocket and the launch rail.

2.2 Payload Summary

Payload Description

The payload this year is designed to solve the challenge presented by the competition. The payload will be incorporated into the avionics bay to centralize all electronics in the rocket. The payload will contain an Arduino, a gyroscope/accelerometer module, a barometric pressure sensor, an SD card module, and a 9V battery. Data will be processed by the microcontroller and outputted to an SD card using the SD card module. The challenge requires that 3 data types are recorded during flight; however, the payload will record 5 data types (rotation, acceleration, pressure, altitude, and temperature). The avionics bay, which contains the payload, will be separated from the rest of the rocket using a wooden CNC'ed locking mechanism and a 3D printed sled. The sled will be designed to firmly house the individual electronic modules. Both the barometric pressure sensor and gyroscope/accelerometer module will be surrounded by an insulating piece of foam to reduce direct contact with the 3D printed sled. This will reduce vibrations experienced by the electronic components and provide more accurate data.

3 Changes Made Since CDR

Changes to Vehicle Criteria

The vehicle has been modified to reflect more accurate measurements from the construction period and to account for actual masses of rocket components. These changes were very minor dimensional corrections from the CDR, except for the addition of one more threaded rod within the launch vehicle, bringing up the total amount of threaded rods to three, and the location change of the locking mechanism to account for the coupler's location within the rocket, which reduced the amount of space in the avionics bay but is still within the desired length indicated by the team.

Changes to Payload Criteria

No changes have been made to the payload since the CDR.

Changes to Project Plan

Manufacturing of the rocket has followed the proper timeline from the CDR. Testing has been pushed back to this week. The rocket is still projected to be 90% complete two weeks prior to the competition.

4 Vehicle Criteria

4.1 Design and Construction of Launch Vehicle

Changes in Launch Vehicle Design Since CDR

The only changes in the launch vehicle design from the CDR was the location change of the locking mechanism and the location of the sled for the avionics bay within the given space for it. Prior to this report, it had been indicated that the locking mechanism would be more central within the rocket, but after close inspection, it was seen that it would have been located where the coupler was. It was not possible to keep the locking mechanism in that location due to the coupler being attached to the lower body tube rather than the upper body tube. This change was necessary because if it had stayed in the position listed in the CDR, the coupler would not have been able to be connected to the upper body tube, which would not keep our rocket in one continuous piece as needed for most of the launch prior to recovery system deployment. The location of the sled also was changed to reflect that it would be attached to the locking mechanism, and not to the top bulkhead within the upper body tube. This was necessary because it moved around mass within the launch vehicle, which affected center of gravity, and therefore, stability.

Structural Elements of Vehicle

Airframe

The airframe consists of two carbon fiber body tubes (Figure 4.1.7) that are connected with a carbon fiber coupler (Figure 4.1.6). This makes up the main body of the rocket and holds the other components critical for the launch and recovery.

Nose Cone

The 3D-printed PLA/ABS nose cone consists of an upper and lower section (Figure 4.1.2) epoxied together and mainly houses the main parachute and most of the recovery components for the main parachute deployment, such as the shock cord, firecloth, etc. It was designed aerodynamically to ensure the rocket would fall within competition guidelines upon launch.
Bulkheads

The pine bulkheads (Figure 4.1.3), whether it be the one housed in the nose cone or the one housed in the upper body tube, are epoxied within the rocket and have drilled in them an eyebolt necessary for the main parachute recovery system, as a quicklink

attached to the shock cord will be attached to each of the eyebolts. These ensure that when the main parachute recovery system is deployed, the main parachute will not fly out of the launch vehicle and will help the rocket have a safe recovery.

Locking Mechanism

The pine locking mechanism (Figure 4.1.8) keeps the avionics bay in an airtight section, which allows for the electronics that power the recovery ejection charges to work at their best, but it also has an eyebolt drilled into it necessary for the drogue chute recovery system. This ensures that when the drogue chute recovery system is deployed, the drogue parachute will remain within the launch vehicle and help the rocket have a safe recovery.

Top Centering Ring

The top pine centering ring (Figure 4.1.4) is epoxied within the lower body tube and onto the motor mount, has threaded rods epoxied onto it for additional mass, and ensures that the motor mount will not move around within the rocket. This ensures a safe launch as the rocket will not be moving left and right due to the motor being moved within the rocket. It also has drilled in it an eyebolt necessary for the drogue parachute recovery system, as a quicklink attached to the shock cord will be attached to this eyebolt. This ensures that when the drogue chute recovery system is deployed, the drogue parachute will remain within the launch vehicle and help the rocket have a safe recovery.

Quicklinks

The quicklinks are attached to the eyebolts drilled through either the bulkheads detailed in the prior paragraph or the locking mechanism and the top pine centering ring and ensure that the shock cord for either parachute, whether the main parachute or the drogue parachute, is securely attached within the rocket. It also ensures a strong connection that can withstand the force applied upon deployment and continue to remain attached within the rocket, which allows for a safe recovery.

Motor Mount

The motor mount consists of a phenolic tube and is centered and epoxied within the rocket in the inner section of the top pine centering ring, the fin securing mechanism and the bottom pine centering ring. This motor mount allows for easy placement of the motor on launch day and keeps the motor centered within the rocket, which will allow for a safe launch upward and not sideways.

Fin Securing Mechanism

The pine fin securing mechanism (Figure 4.1.5) is epoxied onto the motor mount and the inner walls of the lower body tube, and it ensures that the fins do not experience a heavy amount of fin flutter, which could affect the launch in a negative manner. It also ensures that the fins are more securely attached to the rocket and will not easily fly out of the rocket during launch.

Fins

The fiberglass fins (Figure 4.1.5) were designed to provide a static stability well within the safe margin of flight but still allow for an apogee within competition guidelines. They ensure that our rocket stabilizes in the air during launch when aerodynamic forces are applied, which allows for a safe launch.

Bottom Centering Ring

The bottom pine centering ring (Figure 4.1.4) and the aluminum centering ring (Figure 4.1.4) are both epoxied either within the inner walls of the lower body tube or on top of the bottom pine centering ring, respectively. They ensure that the motor mount maintains its position within the rocket and the motor within does not move around within the rocket, which ensures a safe launch.

Motor Retainer

The motor retainer is screwed on top of the aluminum centering ring and ensures that the motor will remain within the rocket during launch and not fly out, which allows for not only a launch, but also a safe one.

Electrical Elements

Retention of Electrical Components

Electrical components will be housed using a 3D printed PLA avionics sled. The sled contains slots for three 9V battery holders, two altimeters (RRC3 and SL100), an Arduino Uno, and two data acquiring instruments (MPU6050 and BMP180). The Arduino Uno and altimeters will be retained in the sled by screwing the electrical components into ⅛” thick plywood. The plywood sheets will be laser-cut to size and epoxied onto the sled.

Wiring

All wiring will be done using standard 22 gauge copper wires. Wires that are charge dependent (i.e. 5V vs GND) will be color coded. The Arduino Uno will be wired using a 9V battery DC adapter for a more secure connection. Wires that interact with the Arduino Uno, the MPU6050, the BMP180, and SD Card module will use standard 22 gauge jumper wires with respective male or female attachments. This will ensure a snug connection with the pins of the individual components and Arduino Uno.

Power and Switches

The altimeters will be attached to a switch outside of the rocket for easier powering using the allotted switch pins on the altimeters. The Arduino Uno does not have a dedicated switch power supply, so the ground and power of the Arduino Uno will be connected using a switch. Batteries will be held using specially 3D printed battery holders which will then attach to the slots designated for the batteries.

Construction

Construction of our vehicle is nearly completed. Details of which aspects have been fully constructed and the construction process can be found in Table 4.1.1 below.

Table 4.1.1: Description of Manufacturing Stages of Each Rocket Component

Component	Manufacturing Stage and Process
Body Tubes	Completed; Was cut with Dremel to size and for the lower body tube, fin slits were cut into it in the location indicated by simulation using a 3D-printed fin aligner
Coupler	Completed; Half the length was epoxied to the inner diameter of the lower body tube and the other half will be friction fit to the upper body tube at launch site
Nosecone	Completed; Two parts were 3D-printed within appropriate slotting to allow for easy attachment, expanding foam was placed at the inner tip of the nose cone, a nose cone bulkhead was epoxied on top of the expanding foam and against the inner walls of the nose cone, and the two parts were epoxied together to ensure one continuous

	piece
Nosecone Bulkhead	Completed; Was CNC'ed, sanded, had an eyebolt drilled into it secured by a nut, and epoxied within the inner top section of the nose cone
Bulkhead	Completed; Was CNC'ed, sanded, had an eyebolt drilled into it secured by a nut, and epoxied within the upper body tube
Locking Mechanism	In the process of completion; Was CNC'ed, sanded, and epoxied together; Needs more sanding and drilling of holes on the locking mechanism, mainly for an eyebolt to be attached and secured by a nut
Threaded Rods	Completed; Epoxied to the top of the top pine centering ring and the inner walls of the lower body tube
Pine Centering Rings	Completed; Was CNC'ed, sanded, had an eyebolt drilled into it secured by a nut, and epoxied to the motor mount and the inner walls of the lower body tube; for the top centering ring, threaded rods were epoxied to it
Fin Securing Mechanism	Completed; Was CNC'ed, sanded, cut fin slots into it to fit the fin tabs, and epoxied onto the motor mount and the inner walls of the lower body tube
Motor Mount	Completed; Epoxied within the rocket in the inner walls of the top and bottom pine centering rings and the fin securing mechanism
Aluminum Centering Ring	Completed; Was manufactured in a machine shop, sanded to fit the motor mount within, and epoxied onto the bottom pine centering ring
Motor Retainer	Procured; Needs to be screwed onto the aluminum centering ring and bottom pine centering ring
Fins	Completed; Design was finalized in the simulation software, cut out from fiberglass with a

	Dremel, and three of the four fins are epoxied within the fin slits and onto the slots of the fin securing mechanism
Rail Buttons	Procured; Needs to be screwed onto the outer wall of the lower body tube equally between two fins

Schematics of As-Built Rocket

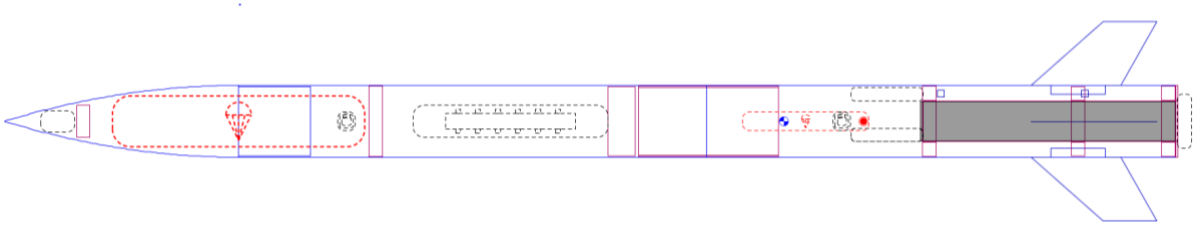

Figure 4.1.1: Cross Section Side View of Rocket from OpenRocket simulation

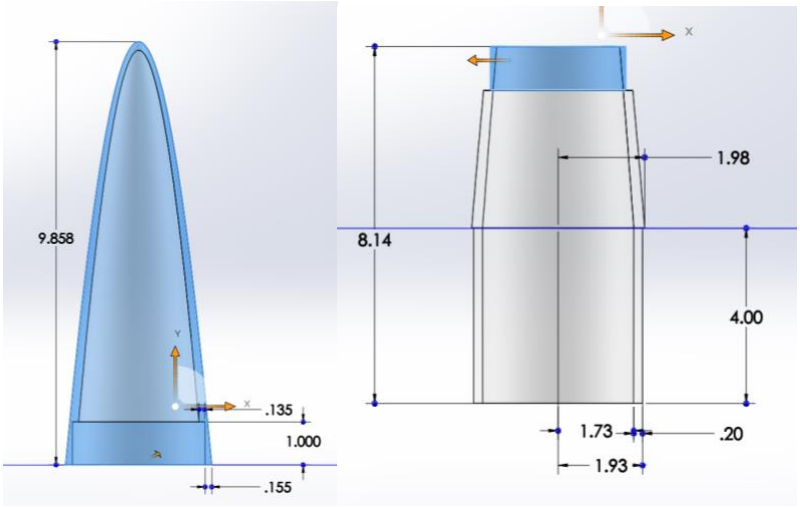

Figure 4.1.2: Left - Top Part of Nosecone (ABS); Right - Bottom Part of Nosecone (PLA); dimensions in inches

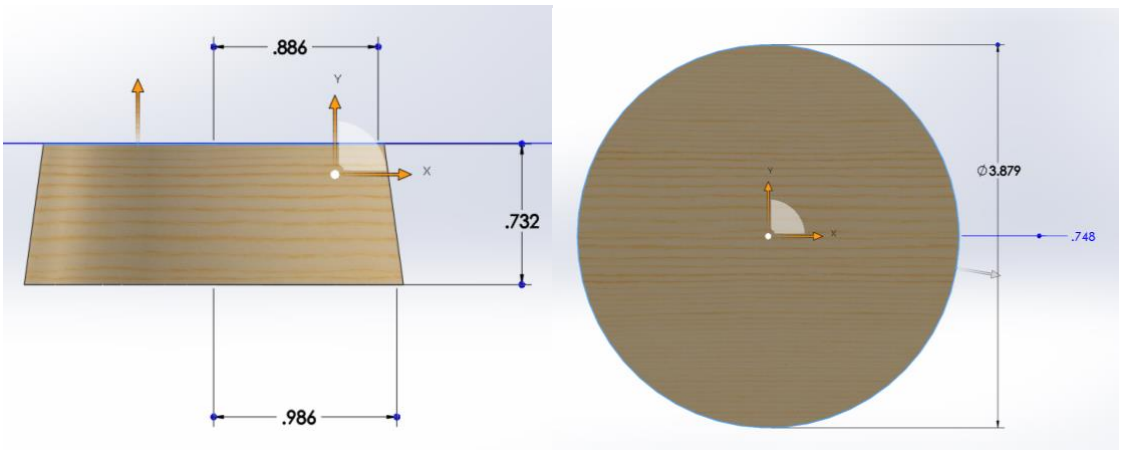

Figure 4.1.3: Left - 0.7320 in thick Pine Nosecone Bulkhead; Right - 0.748 in thick Pine Bulkhead; dimensions in inches

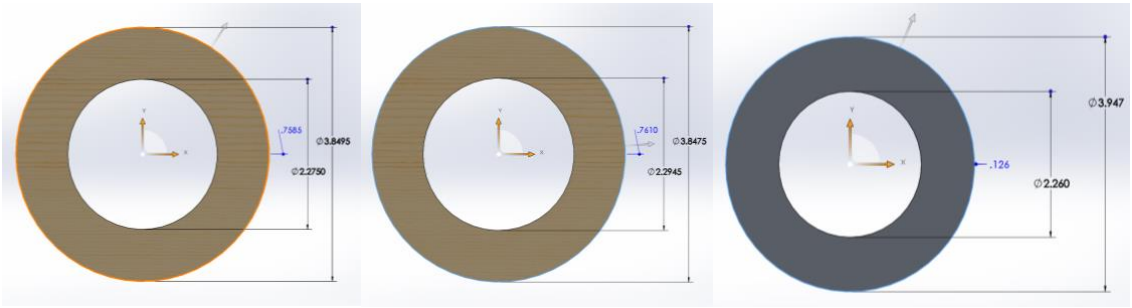

Figure 4.1.4: Left - 0.7585 in thick Bottom Pine Centering Ring; Middle - 0.7610 in thick Top Pine Centering Ring (for attached rods); Right - 0.126 in thick Aluminum Centering Ring; dimensions in inches

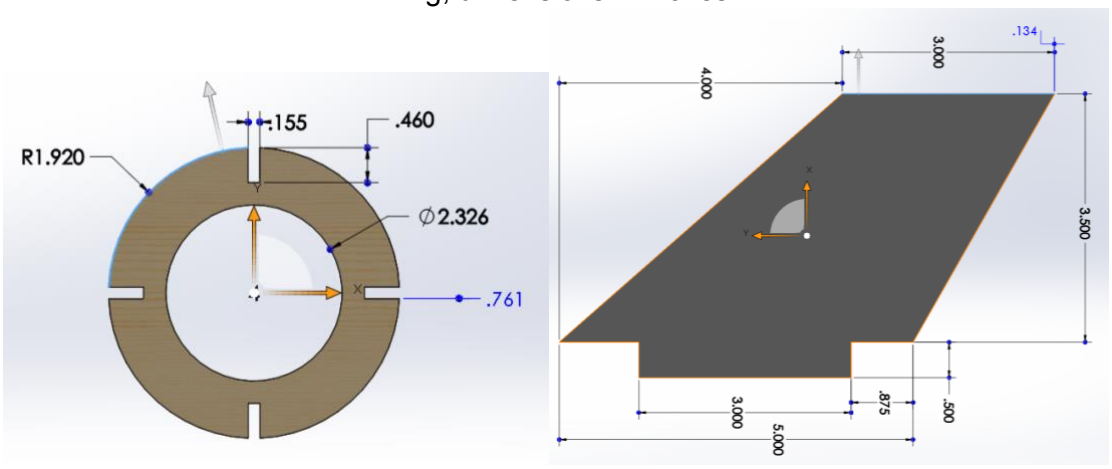

Figure 4.1.5: Left - 0.761 in thick Pine Fin Securing Mechanism; Right - 0.134 in thick Fiberglass Fins; dimensions in inches

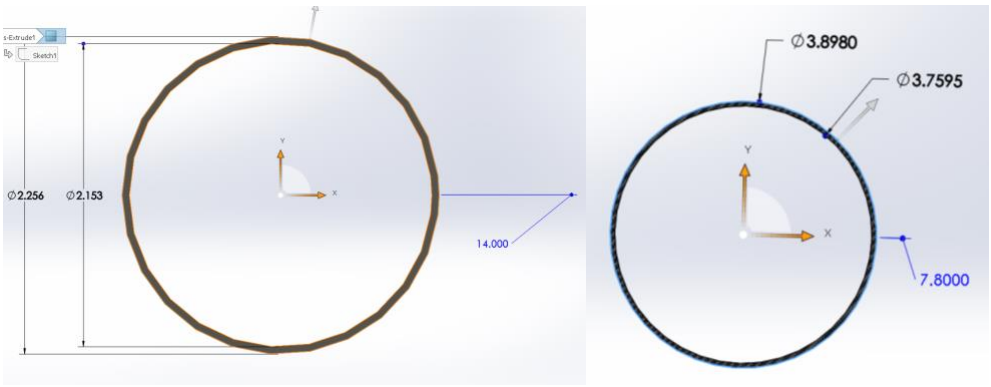

Figure 4.1.6: Left - 14 in long Motor Mount; Right - 7.8 in long Carbon Fiber Coupler; dimensions in inches

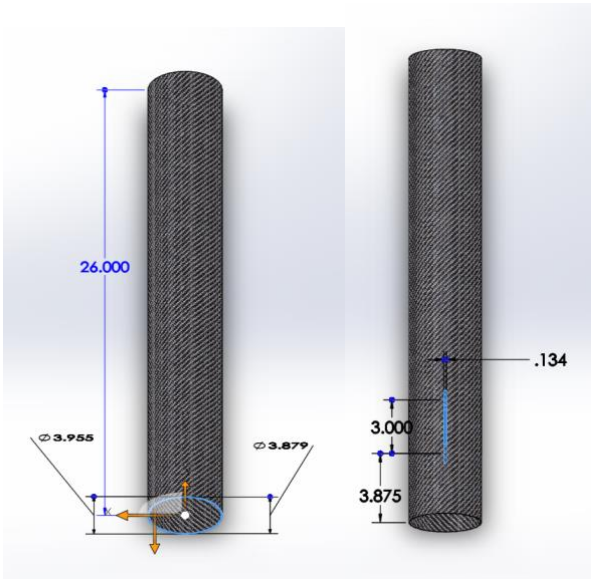

Figure 4.1.7: Left - 26 in long Upper Body Tube; Right - 26 in long Lower Body Tube (figure displays slits dimension and location); dimensions in inches

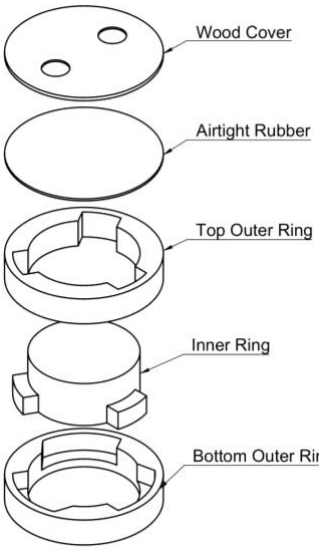

Figure 4.1.8: Blow of up view of the locking mechanism. Two holes will be drilled through the inner ring, rubber sheet, and wood cover to attach an eyebolt and allow wires to pass.

Discussion of Changes

The constructed rocket differs from earlier models in very minor ways, whether it be additional sanding in all of the wooden parts manufactured as to fit within the rocket or in the attachment slot of another part, or additional use of the Dremel to cut away more material, whether wood, carbon fiber, or aluminum, to easier fit within the rocket. It also differs very slightly in the location of certain parts within the rocket as human error would not perfectly allow a component to be in the exact position indicated in simulations. The constructed rocket also differs from earlier models in location changes of certain components, such as the nose cone bulkhead and the locking mechanism, as manufacturing revealed slight problems in the placement of them within the rocket, which included the locking mechanism being in the way of the coupler and the nose cone bulkhead needing to be further in the nose cone in order to leave enough space for the main parachute. The constructed rocket also differs with the addition of adhesives, such as epoxy or screws, for parts; earlier models never indicated how each part would be attached within the rocket and never accounted for it.

The constructed rocket differs from earlier models mainly due to human error within the construction process, whether the lack of ultra-precise manufacturing or limitations of available machinery. The constructed rocket takes into account parts that were sanded to fit within the rocket more smoothly and other parts that were cut further to adequately fit their attached parts, such as fins to the fin securing mechanism. Earlier models indicated what the design could look like if there were no errors in the manufacturing process. In addition, earlier models did not take into account any problems faced in the

manufacturing process, such as parts not fitting together, or a machine necessary to manufacture a piece not working, or multiple redesigns of the same part to achieve the best version for the part.

4.2 Recovery and Avionics Subsystem

Robustness of Structural Elements

Since the avionics bay is not completed, it is difficult to quantify the robustness of the attached hardware. An approach similar to last year has been taken for the avionics bay this year, so similar results are expected. All electrical components will be placed in the avionics bay in the designated slots for each electrical component. The two altimeters and Arduino Uno will be fastened onto a thin sheet of plywood using screws and will be epoxied onto the sled. This is to prevent damage to the modules and to have increased surface area when epoxying the parts onto the sled. The batteries will be secured using 3D printed 9V battery holders and will be epoxied onto the sled.

Robustness of Electrical Elements

Table 4.2.1: Operating conditions of electrical components

Component	Operating Temperature (°C)	Operating Pressure(hPa)
Arduino Uno	-40 to 85	N/A
MPU6050	-40 to 85	300 to 1100
BMP180	-40 to 105	N/A
SD Card Module	-40 to 85	N/A

All electrical components have operating conditions that exceed the conditions experienced during flight, as shown in Table 4.2.1. The robustness of each component ensures no failure occurs during flight. All connections between the altimeter and ignition charges are done using standard 22 gauge copper wires. The two batteries hooked up to the two altimeters will also employ these wires. All connections made to the Arduino will use 22 gauge jumper wire cables with respective male or female adapters. The jumper cables with adapters ensure a steady connection, however, the cables will also be taped together to prevent slipping between adapter and the component's male or female pin. The battery that powers the Arduino will be connected using a 9V DC adapter as this will be easier to connect than through the respective 5V

and GND pins on the Arduino. The switches are also robust as they are difficult to remove once locked and require a crimping tool to lock the wire with the switch.

Redundancy Features

Two altimeters will be used for redundancy. The main altimeter will be the RRC3 Sports Altimeter and will immediately deploy the drogue chute at apogee and the main chute 500 feet above ground level. The redundant Stratologger100 altimeter will deploy the main parachute three seconds after the main altimeter and at 500 feet above ground level as well. No redundant electrical components will be used for the payload since they have been tested and the payload's task is not as critical as recovery.

Parachute Sizes and Descent Rates

The main parachute has a diameter of 60 inches and the drogue parachute has a diameter of 21.5 inches. The descent rate after the drogue chute is deployed is 63.5 ft/s and decreases to 21.2 ft/s when the main parachute is deployed.

Schematics of the Electrical and Structural Assemblies

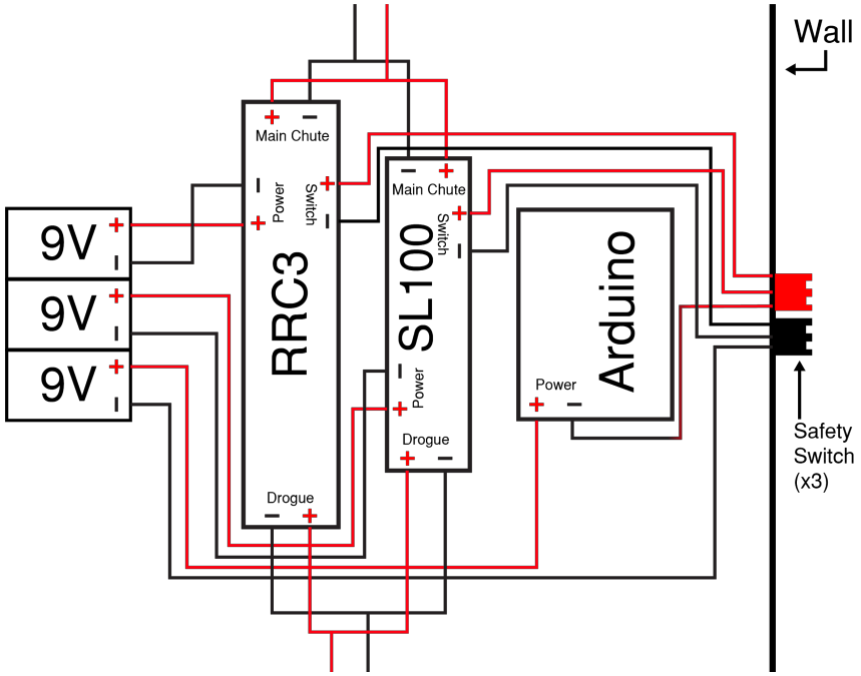

Figure 4.2.1 Avionics schematic highlighting the use of safety switches with the altimeters and microcontroller. Each major component will have its own set of safety switches for a total of three safety switches. Since the Arduino has no pins for switches, the ground of the battery will be attached to the switch, which induces a current once the switch is connected.

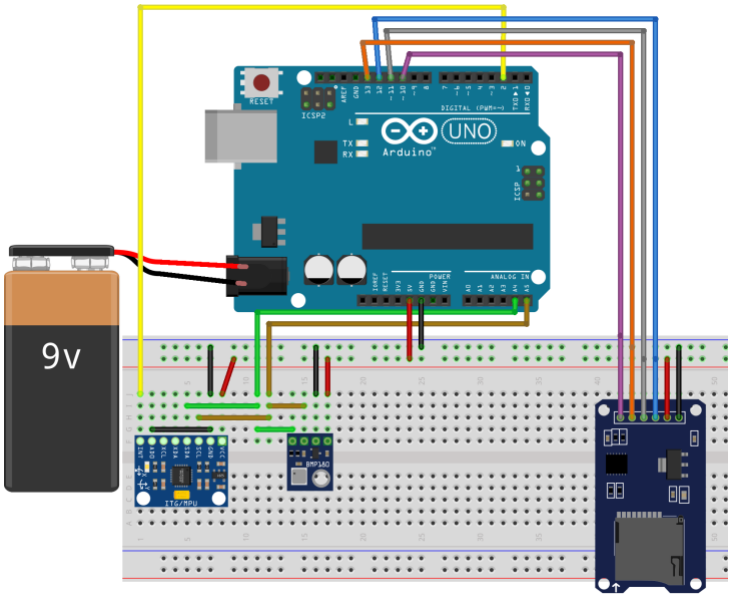

Figure 4.2.2 Wiring schematic of the payload. Shown here is the Arduino Uno hooked up to the MPU6050 (bottom left), BMP180 (bottom middle), and SD Card module (bottom right). The assembly is powered by a single 9V battery using a DC adapter plug.

Rocket-Locating Transmitters

No GPS or rocket-locating transmitters will be used. While the recovery system may be sensitive to such devices, none will be located on board and thus the recovery system will be unaffected.

Parachute Sizes, Attachment Scheme, Deployment Process, and Test Results

The main parachute is made of ripstop nylon and is 60 inches in diameter. It has 16 shroud lines made from heavy duty thread that are connected to a 28.05 ft shock cord that uses three quicklinks to attach it to the eyebolts drilled into the bulkheads in the nosecone and top of the top body tube. It also has a firecloth attached to the shroud lines so as to wrap the half of the parachute that is exposed to the black powder ejection charges while in the rocket to ensure that it is not damaged. The parachute has been inspected for holes and rips visually and any that were found were patched with parachute tape that does not tamper with the integrity or effectiveness of the parachute. This parachute was selected because its size allows it to be easily folded into the rocket and can be deployed without issue. It's also large enough to lower the rocket's ground hit velocity to within competition guidelines.

The drogue chute is 21.5 inches in diameter and made of the same material as the main parachute and has 6 shroud lines. The shroud lines are attached to a 25 ft shock cord

as well as three quicklinks that connect the parachute to the top of the motor and the bottom of the top body tube (essentially each of the body tubes). The drogue chute also has a firecloth attached to it so that, like the main parachute, it will be protected from the ejection charges within the rocket when folded. The attachment scheme of the main chute and drogue chute can be seen in Figure 4.3.2.

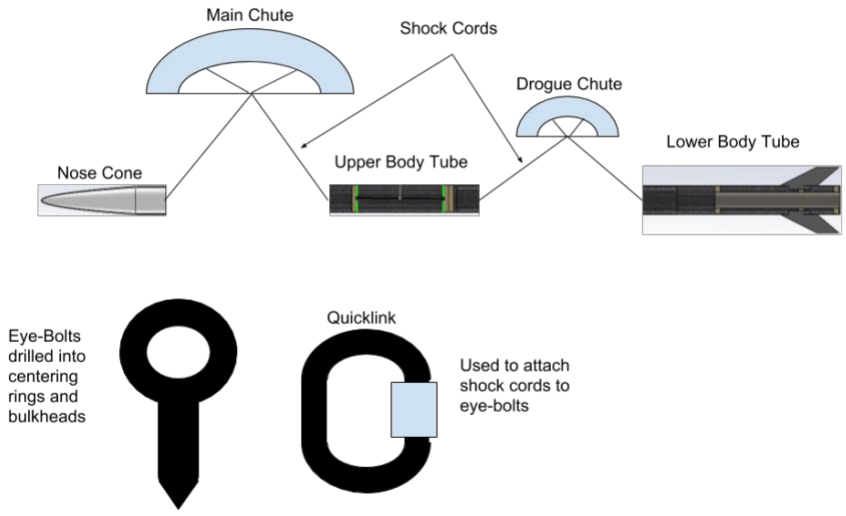

Figure 4.3.2: Attachment scheme of parachutes in rocket recovery system.

The drogue parachute is deployed at apogee. This is programmed into the altimeters which will set off the ejection charges. The blast from these charges will provide enough force to induce the failure of the shear pins, separating the upper body tube from the lower body tube and deploying the drogue chute. The same occurs for the main chute at an altitude of 500 ft, where the ejection charges result in the separation of the nose cone from the upper body tube.

The two altimeters have been tested to ensure that they accurately measure altitude and that they are capable of sending signals. They have not been actually tested in conjunction with ejection charges because we will not have access to them until the competition. However, we are confident in the functionality of our recovery system based on the success of past years' rocket launches.

4.3 Mission Performance Predictions

Official Target Altitude

Based on the simulations and data presented in this section, UCLA Bearospace's official launch day target altitude depends on the windspeed conditions of launch day. The predictions presented in Table 4.6.1 are these variable target altitudes between 4117-4145 ft. Due to meticulous mass and position measurements for all component pieces, the current simulation is as close as possible to the actual high-powered rocket that will be launched. Due to this launch being the first one in past years that will launch with such accuracy in the simulation, we choose to make our apogee prediction align with the simulation values.

Our team's official launch day target altitude is **4041 ft**.

Simulated Vehicle Data, Motor Thrust Curve and Component Weights

For our simulations we set five windspeeds of 0, 5, 10, 15, and 20 MPH, with a 72" launch rail oriented straight up. Below are shown the simulated vehicle data (Table4.6.1), component weights (Table 4.6.2) and motor thrust curve (Figure 4.6.1) from the 0 MPH windspeed calculation. The weight and thrust data are not affected by windspeed therefore only one set will be shown.

Table 4.6.1: Vehicle Data

Vehicle data for three simulations of 0, 5, 10, 15 and 20 MPH, it can be observed that the apogee generally decreases with increasing windspeed, indicating increased stress on the rocket.

Windspeed	**0 MPH**	**5 MPH**	**10 MPH**	**15 MPH**	**20 MPH**
Motor Configuration	J450DM-14	J450DM-14	J450DM-14	J450DM-14	J450DM-14
Velocity off Rod	57.9 ft/s	57.9 ft/s	57.9 ft/s	57.9 ft/s	57.9 ft/s
Apogee	4145 ft	4138 ft	4129 ft	4117 ft	4119 ft
Velocity at Main Chute Deployment	63.4 ft/s	63.4 ft/s	63.4 ft/s	63.4 ft/s	63.5 ft/s
Optimum Delay for Ejection Charge	13.2 s	13.2 s	13.2 s	13.2 s	13.2 s
Max Velocity	643 ft/s	642 ft/s	642 ft/s	641 ft/s	641 ft/s
Max Acceleration	345 ft/s^2	345 ft/s^2	345 ft/s^2	345 ft/s^2	345 ft/s^2
Time to Apogee	15.5 s	15.5 s	15.5 s	15.5 s	15.5 s
Flight Time	94.5 s	94.8 s	94.6 s	94.8 s	94.4 s

Ground Hit Velocity	21.2 ft/s	21.2 ft/s	21.1 ft/s	21.2 ft/s	21.2 ft/s

Table 4.6.2: Component Weights.

Fin mass is simulated with OpenRocket material data and component dimensions, this is denoted by its italicized component name.

Component	**Mass (oz.)**	**Component**	**Mass (oz.)**
Motor Mount Body Tube	10.3	Avionics Body Tube	10.5
Trapezoidal Fin Set	9.22	Coupler	4.13
Pine Centering rings (2)	4.02	Locking Mechanism	5.95
Drogue Chute + Recovery Hardware	11.96	Pine Bulkhead	2.72
Phenolic Tubing	2.72	Main Parachute	7.58
Aluminum Centering Ring + Motor Retainer	3.28	Avionics Bay	10.9
Fin Securement Mechanism	1.65	Recovery Hardware	8.68
Rail Buttons	0.134	**Subtotal (Avionics B.T.)**	**50.4**
Corrective Mass Elements (3)	21.06	Nosecone	7.44
Subtotal (Motor Mount B.T.)	**64.3**	Nosecone Bulkhead	1.7
Motor	**42**	**Subtotal (Nosecone)**	**9.14**
		Grand Total	**165.84**

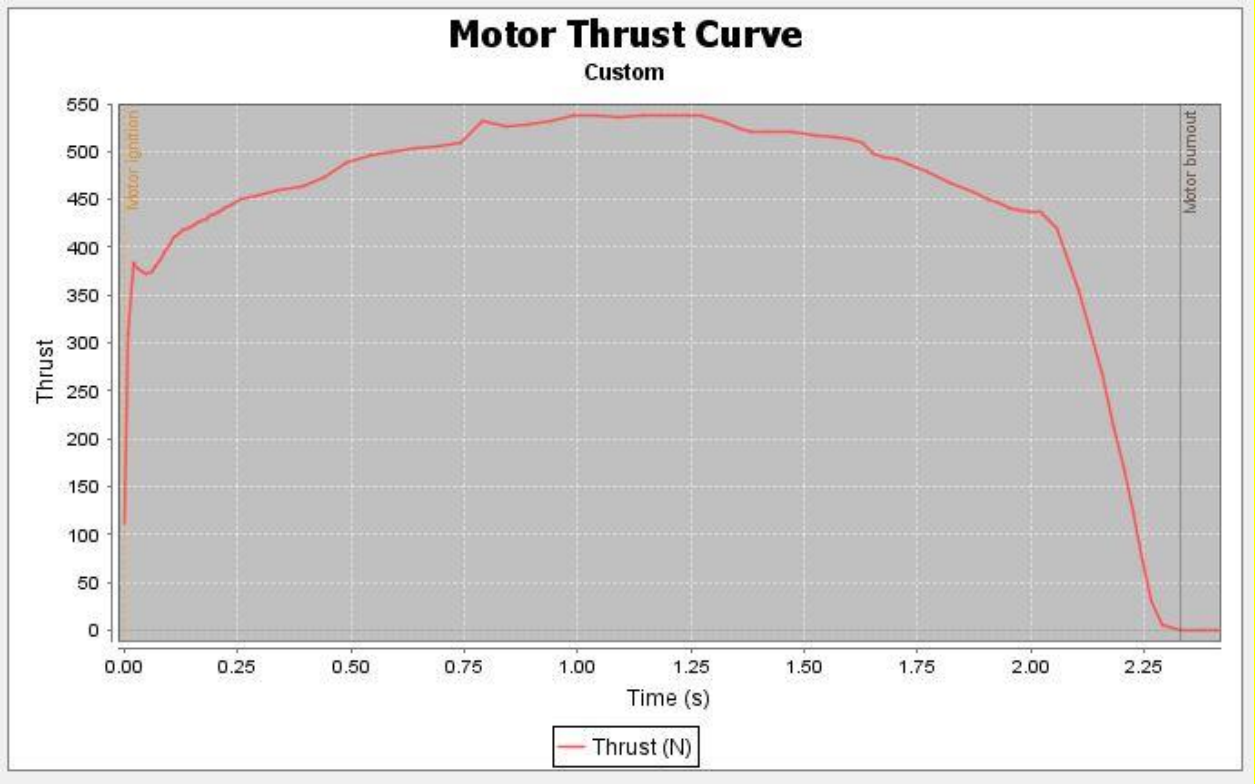

Figure 4.6.1: Simulated Motor Thrust Curve Plot

Flight Profile

Figure 4.6.2 below shows the altitude, vertical velocity and vertical acceleration over time with flight events indicated. This flight simulation was defined with a no wind condition and the launch coordinates and altitude of Kenosha, Wisconsin: 42.6 ° N, 87.8 ° E, altitude 604 ft.

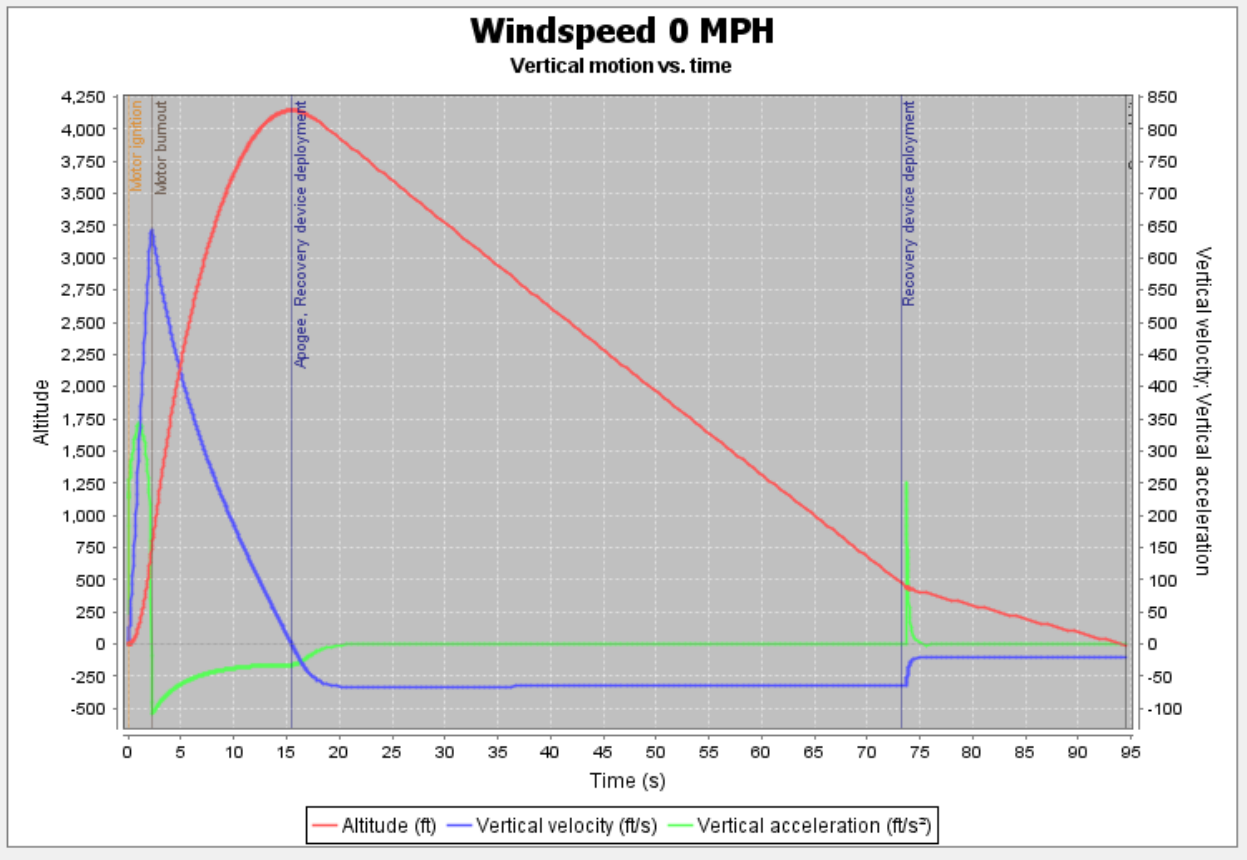

Figure 4.6.2: No Wind Flight Profile - Altitude, vertical velocity and vertical acceleration for a no wind simulation.

Stability, CP and CG

Stability is the ratio of the center of Gravity (CG) by the Center of Pressure (CP), with both quantities measured in inches from the tip of the nosecone. A schematic of their locations on the rocket is shown below in Figure 4.6.3.

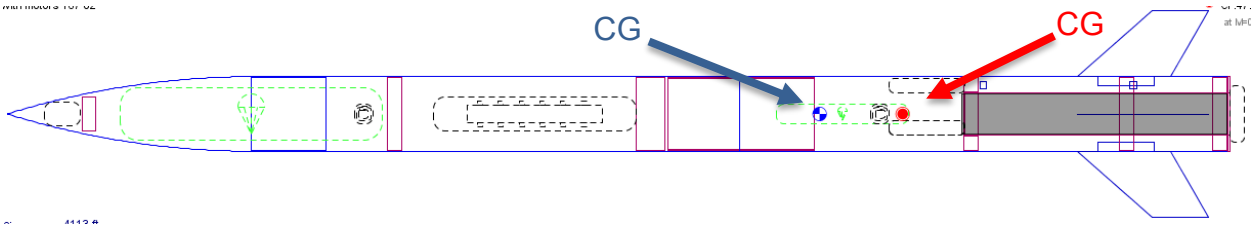

Figure 4.6.3: Simulated Stability, CP, and CG on OpenRocket - Both the CG and CP are shown on the area of the coupler, indicated with a blue and red arrow respectively. CP: 47.707 in, CG: 43.283 in, Stability Margin: 1.12 cal

Descent Rate and Time

From simulation data, descent rate is 63.5 ft/s under the drogue parachute until the main parachute deploys at 500 ft AGL and reduces the rate to approximately 21.2 ft/s. Subtracting flight time (94.4) from time to apogee (15.5) we can calculate total descent time to be **78.9 s**.

Kinetic Energy at Landing

With the ground hit velocity of 21.2 ft/s we can calculate the kinetic energy of the rocket:

$$KE = \frac{1}{2}mv^2$$

For the mass we will assume complete motor burn and take the mass of the rocket with a motor (165.84 oz) and subtract the propellant mass (23.35 oz).

$$KE = \frac{1}{2}(142.49\ oz)\left(\frac{.0625\ lb}{1\ oz}\right)\left(21.2\ \frac{ft}{s}\right)^2 = 94.4\ \text{ft} \cdot \text{lbf}$$

Drift

From figures 4.6.4-4.6.8, we can determine the drift from the launch pad with the assumption that the apogee is directly above it. This is done by adding the drift from the launch pad to apogee to the final drift location. Table 4.6.3 is a summary of these different drifts.

Table 4.6.2: Drift from Launchpad *Assume apogee occurs directly over launchpad

Windspeed (MPH)	Drift from launchpad* (ft)
0	1.5
5	550
10	1100
15	1700
20	2250

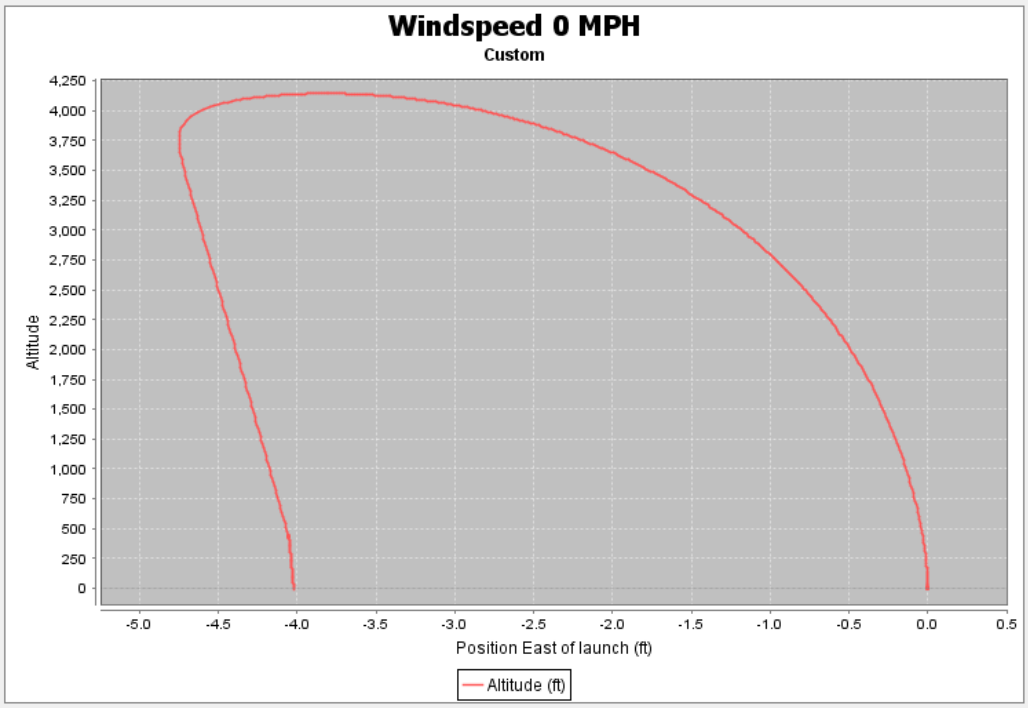

Figure 4.6.4: No Wind Simulation Plot - Flight profile of a no wind simulation

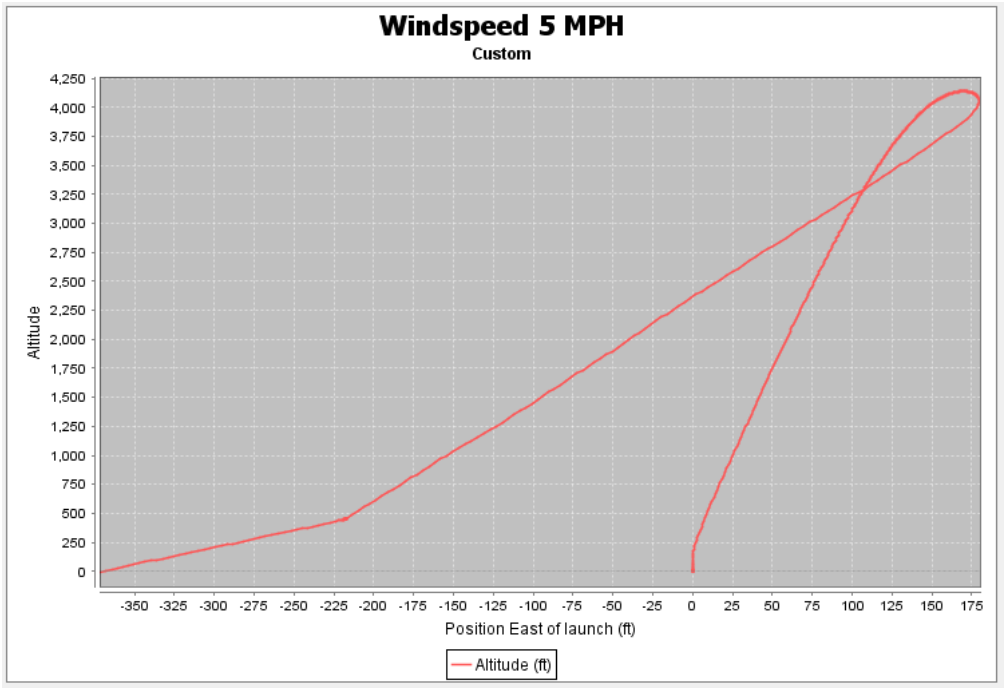

Figure 4.6.5: 5 MPH Wind Simulation Plot - Flight profile of a 5 MPH south eastern wind simulation with rocket position indicated in ft east of launch

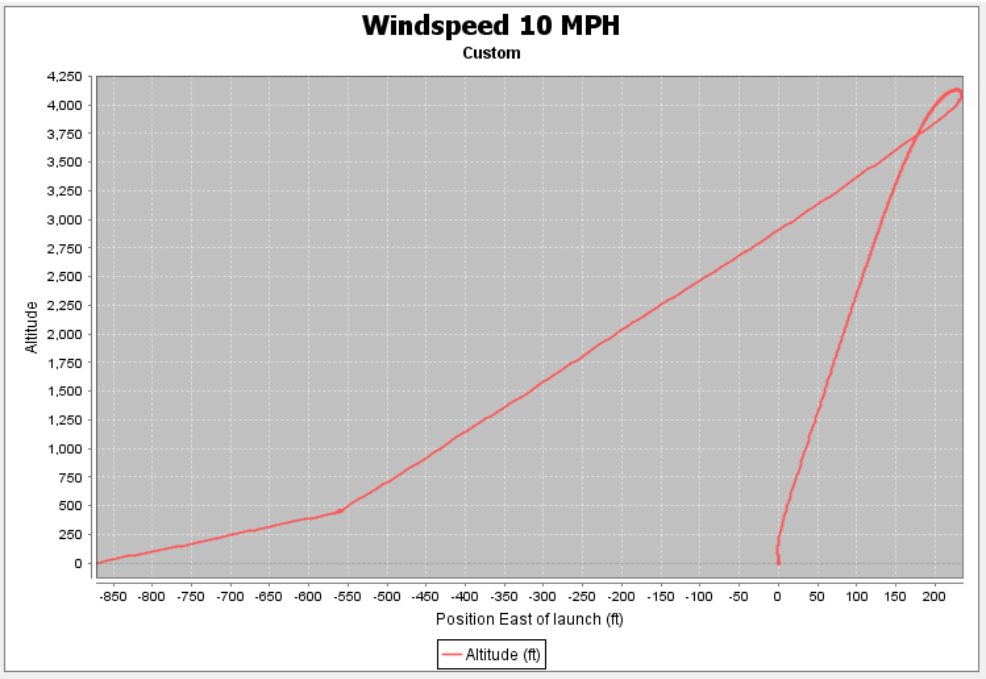

Figure 4.6.6: 10 MPH Wind Simulation Plot - Flight profile of a 10 MPH south eastern wind simulation with rocket position indicated in ft east of launch

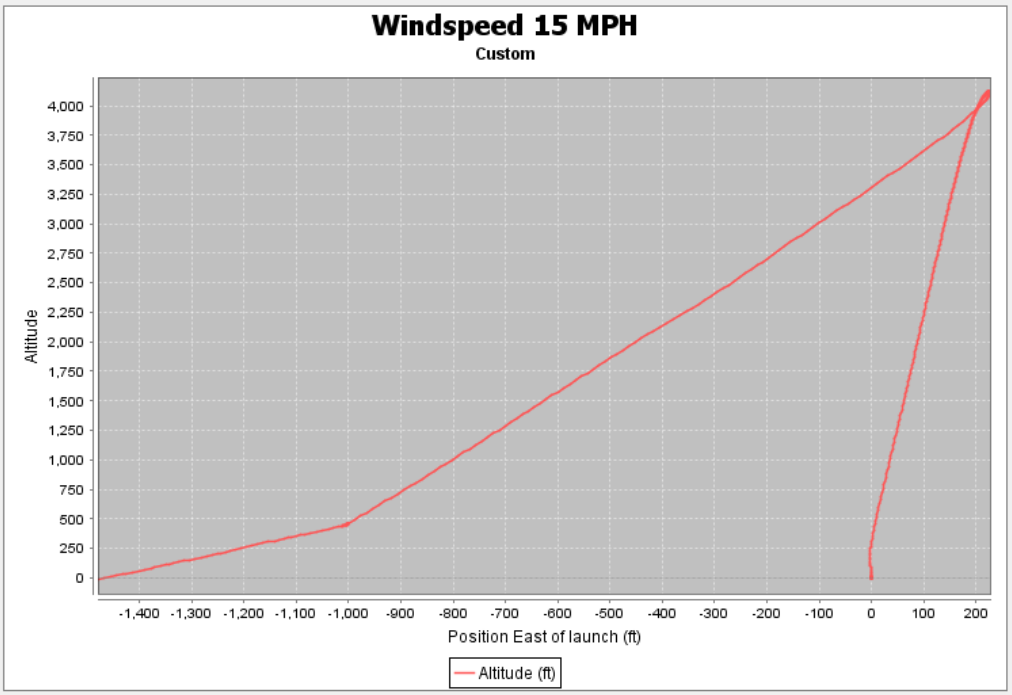

Figure 4.6.7: 15 MPH Wind Simulation Plot - Flight profile of a 15 MPH south eastern wind simulation with rocket position indicated in ft east of launch

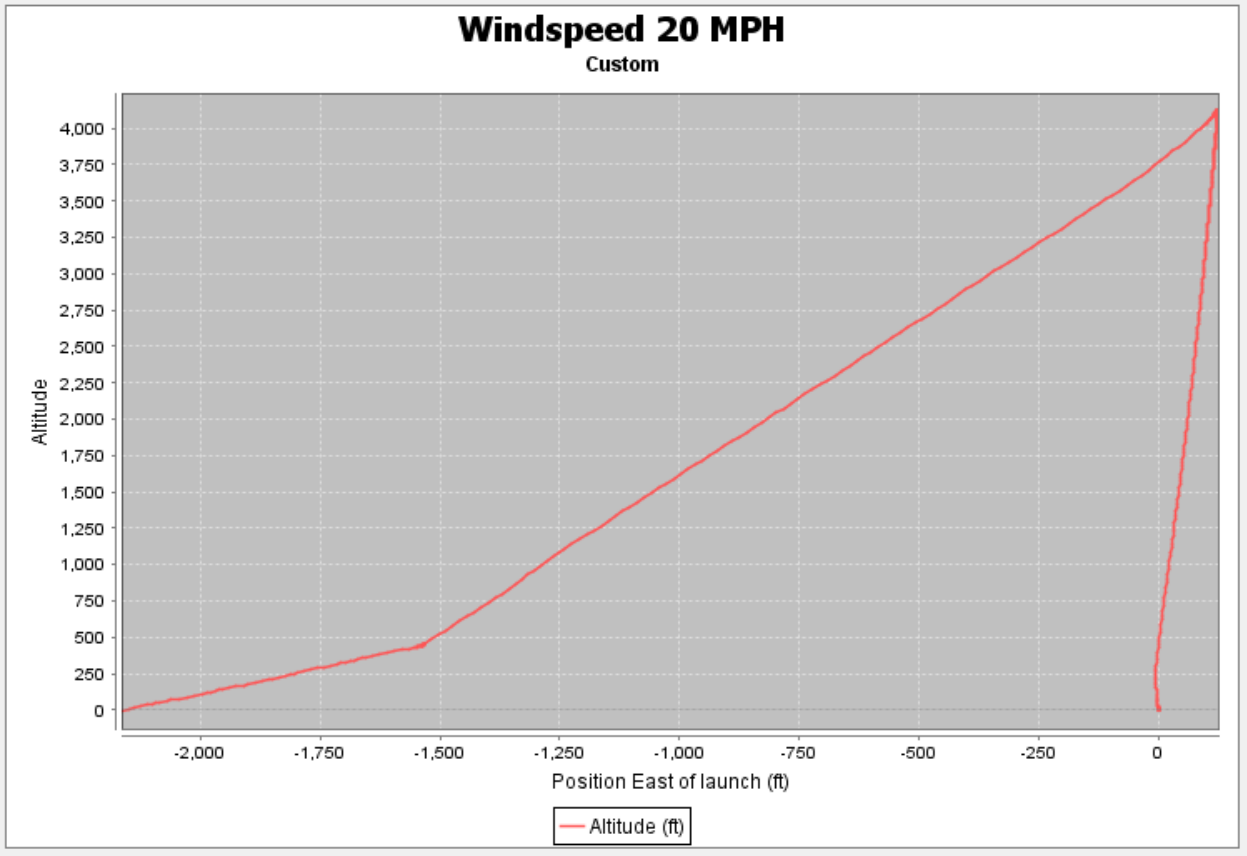

Figure 4.6.8: 20 MPH Wind Simulation Plot - Flight profile of a 20 MPH south eastern wind simulation with rocket position indicated in ft east of launch

5 Safety and Procedures

5.1 Launch Operation Procedures

On launch day, there are many preparations that must be made on the way to, and at the launch pad. The procedures that must be completed are the following: recovery apparatus preparation, motor preparation, launch pad setup, igniter installation, launch, troubleshooting, and post-flight inspection. All of the procedures above have a corresponding checklist of steps that must be completed in order for that procedure to be properly executed. The checklists are provided in the order the procedures were presented. First is the recovery checklist, which details how the recovery apparatus for our rocket is loaded into the craft.

Recovery Checklist:

1. Fold the main parachute and drogue chute
   Hazard: If the main parachute is improperly folded it may not be able to properly deploy, causing damage to the rocket upon landing.
2. Attach the main parachute to the shock chord
3. Pack a firecloth in between the main parachute and black powder charge
   Hazard: If the firecloth is not properly packed, the parachute may be damaged when the black powder charge goes off
4. Pack the main parachute into the section between the upper body tube and nose cone
   Safety: Make sure gloves are worn during the next step
5. Use graphite powder to lubricate the inside of the section if necessary
6. Insert drogue chute

The motor preparation checklist details how to load the J450DM motor into the proper section of the rocket so the actual launch proceeds smoothly.

Motor Prep Checklist:

1. Load the motor into the rocket via the bottom body tube
2. Secure the motor retainer
   Hazard: If the motor is not secured properly then there is a chance that it will fall out or the rocket will take off at a dangerous angle
3. Align the launch buttons

After the motor and recovery parts have been installed, the launch pad setup of the rocket can begin. The following checklist details how to prepare the rocket right before launch. Part of this checklist is igniter installation and launch, but the specific checklists for those procedures are included afterwards.

Launch Pad Setup Checklist:

1. Affix the rocket to the launch rail
   Hazard: It's important the altimeters aren't primed until the rocket is at the launch pad, in case of altimeter malfunction that would cause the charges to go off while people are working on the rocket
2. Prime the altimeters
3. Check for altimeter malfunction
4. Install igniter properly
5. Everyone retreats to a safe distance
6. Launch
   Safety: The Range Safety Officer should be present for launch pad setup and will make sure all steps are performed correctly

To reduce the chance of an accident in the work area, where other teams will be present, the igniters aren't installed until the rocket is on the launch pad and the specific procedure is outlined below.

Igniter Installation Checklist:

1. Have at least one team member attend an igniter installation workshop
2. Attach the igniter
   Hazard: If the igniter is not installed properly the motor may not ignite, ignite early, or undergo some other kind of failure which may result in personal injury to bystanders nearby
3. Attach alligator clips to igniter ends
4. Attach alligator clips to launch box

Once the rocket is setup on the launch pad and the RSO approves of the setup, the launch procedure can take place.

Launch Procedure:

1. All team members working on launch pad setup must retreat to a safe distance
2. Initiate a countdown
3. Launch the rocket
4. If the rocket fails to launch, move to troubleshooting

   Safety: Since no member of our rocket team has certification and in accordance with the competition guidelines, the Range Safety Officer (RSO) will oversee the launch and countdown.

If there's a problem during launch and the rocket fails to take off then the troubleshooting checklist comes into play.

Troubleshooting Checklist:

Safety: When troubleshooting the rocket the Range Safety Officer (RSO) must be present and okay the team to attempt to find the problem

1. Motor - Check the wiring to ensure its securely attached
2. Altimeter - Listen for beeps that indicate whether or not the altimeter is working properly
3. Charges - Ensure that the safety switch is engaged

After a successful rocket launch and flight, our rocket must be retrieved so we can analyze the data it recorded and potentially launch again. The following checklist details how to go about recovering the rocket.

Post-flight Inspection Checklist:

1. Locate the rocket and request assistance retrieving it if it has landed in a tree or other location where it is unsafe to retrieve by ourselves

   Safety: The safety officer must be present when the rocket is being recovered to determine whether or not it's safe for the team to retrieve without any assistance

   Hazard: If team members attempt to recover the rocket while it's in a tree or otherwise hard to reach location, they could injure themselves and/or damage the rocket

2. Inspect the airframe and fins of the rocket for visible damage
3. Make sure parachutes have not acquired any holes or damage
4. Carefully inspect the inside of the rocket to make sure nothing was damaged significantly (including the electronics bay)
5. Recover data from microcontroller and altimeters

5.2 Safety and Environment (Vehicle and Payload)**

A finalized list of hazards, their causes, effects, and mitigations are provided in Table 5.2.1. This list has been updated to include hazards that our rocket poses to the environment and their corresponding mitigations. The MSDS for all hazardous materials that we will be working with are provided in the Appendix. The Safety Officer, Joshua Diaz, is responsible for ensuring that all mitigations are verified, and verifications are provided after the following table.

Table 5.2.1: Personnel Hazard Analysis and the Failure Modes and Effects Analysis

Hazard	Effects	Cause	Severity	Chance	Mitigations	Impact of Mitigations
Build Hazards						
Carbon Fiber / Fiberglass Dust Inhalation	Both materials known to cause health problems given long enough exposure	Cutting Carbon Fiber or Fiberglass material with a Dremel in a dry environment	Medium	Low	P100 rated respirator masks and filters, a lab coat, gloves, and goggles will be worn when working with these materials along The materials will only be cut in a safe workspace in accordance with UCLA EH&S policy	The workspace that the materials must be cut at has to be notified 48 hours in advance and may not always be available Disposable PPE stock must be maintained, which affects the budget ($108)
Inhalation of Lead Fumes	Lead has been known to cause mental health problems when ingested or inhaled	Using lead based solder	High	Low	Lead based solder will not be used If lead based solder is used, it will be done in an environment with a fan to diffuse the fumes away from the user	Instead of lead-based solder the team must buy solder wire that does not contain lead, which may impact budget The tools to use lead based solder (mainly the fan) are located in a UCLA facility that has its own hours of operation and thus impacts the schedule
Use of Machining Equipment (Lathe, Drill Press, Dremel)	Potential team member injury if used improperly	Inexperienced team member improperly using machining equipment	High	Low	All team members will be trained on equipment by UCLA staff or experienced members, and supervised when	Team members will have knowledge and guidance, but schedules of team members must be coordinated

					machining	
Spilled epoxy resin and/or hardener	Improper use of epoxy or accident occurs while someone is using epoxy	Inexperienced team member working with epoxy and/or poor communication of the work going on in the area	Medium	Low	Team members will be trained on how to use epoxy and supervised until they are capable Epoxy work will be well communicated when it is going on	The schedules of team members will have to be coordinated so an educated member is always present
Launch Day Hazards						
Improper parachute folding and/or packing	The parachute does not deploy and the rocket plummets to the ground, potentially damaging it and the chances of a second launch	Inexperienced team member folded the parachute or the parachute wasn't tested to see if it could deploy	High	Low	The packing of the parachute will be rehearsed and an experienced member will teach someone else how to fold the parachute so not only one person knows	Schedules will have to be coordinated and a knowledgeable member must be present in Wisconsin
Improper packing of the firecloth	The parachute or bulkheads of the rocket could be damaged resulting in the parachute not deploying, inaccurate data readings in the avionics bay, or other damage	Inexperienced team member packing the firecloth or no verification by an experienced member of the packing job	High	Low	When the packing of the parachute is being practiced, this step will also be rehearsed in the same manner	Schedules will have to be coordinated and a knowledgeable member must be present in Wisconsin
Motor isn't secured appropriately	Our rocket would take off at an unknown trajectory, possibly injuring bystanders and perhaps destroying the rocket	Inexperienced team member mounted the motor without guidance	High	Low	Inexperienced team members will be taught by those who have mounted a motor before	A knowledgeable member should be present in Wisconsin which could be a scheduling challenge
Altimeters	The black	Team member	High	Low	Inexperienced	A knowledgeable

primed at the wrong time	powder charges could potentially go off on the launch pad or not at all	didn't follow the checklist and/or was inexperienced			team members will be taught by those who have primed the altimeters before and there is also a safety workshop	member should be present in Wisconsin which could be a scheduling challenge
Igniter installed incorrectly	Motor could go off earlier, later, or not at all resulting in potential injury of bystanders	Team member didn't attend workshop or was otherwise inexperienced	High	Low	Inexperienced team members will be taught by those who have primed the altimeters before and there is also a safety workshop	A knowledgeable member should be present in Wisconsin which could be a scheduling challenge
Team member attempts to retrieve the rocket from a dangerous position	Team member could injury themselves	Safety Officer incorrectly evaluated the position the rocket landed as not dangerous or failed to stop a reckless team member	High	Low	Safety Officer must accompany the team members retrieving the rocket and identify whether assistance is required	The Safety Officer must be present in Wisconsin which could be a scheduling challenge
Environmental Hazards						
Rocket lands in a body of water	Any residue from the motor propellant and graphite powder would contaminate the watery environment	Rocket trajectory caused it to land in water (due to wind perhaps)	Low	Medium	The most that can be done here is to ensure the stability of the rocket is within a good range (rockets response to crosswinds is damped properly)	No notable effects of the mitigation as it is already part of the design process
Rocket suffers a major malfunction and a piece breaks off and lands in the environment	Rocket parts are mostly not biodegradable so it could contaminate the surroundings for a considerable amount of time	Various reasons, to cause a piece of the rocket to break off a major malfunction with the motor or black powder charges is	Medium	Low	Copious review of the design and using strong, quality components	No notable effects of the mitigation as it is already part of the design process

		probably at the root				

Table 5.2.2 shows the corresponding verifications to the mitigations proposed above.

Table 5.2.2: Verification Plan for Mitigations

Mitigation	**Verification**
PPE used when cutting fiberglass or carbon fiber with a Dremel, which includes a lab coat, gloves, goggles, and a P100 rated respirator	Checklist: 1. Team member must already be wearing long pants, closed toe shoes, and no loose clothing 2. Team member must then put on a lab coat, gloves, goggles, and a P100 rated respirator 3. If any of the above are missing, the team member will not be allowed to cut fiberglass or carbon fiber
Carbon fiber and fiberglass will only be cut in the workspace designated by UCLA Environmental Health and Safety Department	Procedure: 1. First, team members will put on the appropriate PPE 2. Team members will then bring the material to be cut to the appropriate workspace designated by EH&S, which is well ventilated and reserved in advance 3. At least one team member present will have experience cutting material before 4. The area where cutting occured will be cleaned up and the dust particles will be disposed of properly
Lead based solder will not be used or will be used with a solder smoke absorber present	Procedure: 1. Lead based solder will not be purchased by the team 2. If lead based solder work is to be done, it will be done in the engineering makerspace at UCLA which is equipped with solder smoke absorbers and lead based solder
Machine training for the drill press, lathe,	Procedure:

and other heavy machining equipment	1. All team members will complete UCLA's online Laboratory Safety Training and Shop Safety Training courses. 2. Members interested in training on machining equipment must contact the Safety Officer, who will set up a training session with UCLA's engineering machine shop 3. When team members machine a part they will have experience beforehand or be accompanied by a team member who already has experience 4. Team members will act respectfully when they use workspaces that are shared with other engineering students
Training team members to use epoxy resin	Procedure: 1. Epoxy will be stored safely, in containers in plastic bags and when retrieved, only as much as is needed will be taken out of the containers and placed in secondary containers to be applied 2. The proper PPE will be worn while working with epoxy, which consists of gloves and a lab coat 3. Team members will inform anyone else working in the same area that there is epoxy work going on in the area 4. An experienced team member will either be performing the epoxy work or supervising it 5. Any unused epoxy will be disposed of in the proper waste container 6. Epoxied materials that are left to dry will have signs posted notifying others that they are not to be disturbed
All Launch Day Hazards Any hazards present on launch day can	Checklist: 1. Bring experienced team members to

be handled by having experienced team members, who have been to a launch day, present and attending the workshops hosted by the personnel on the days leading up to launch day	Kenosha, Wisconsin 2. Attend all workshops hosted by the NAR and Tripoli associations

As our project moves into the operational phase of its lifecycle, our only concerns are with the transportation of the rocket to Wisconsin from UCLA. This represents the biggest opening for damage to occur to the rocket as we cannot supervise it during transportation. Other than that, the design of our rocket has minimal impact on the environment and all mitigations have been properly followed to this point, so there are no major safety concerns.

6 Payload Criteria

6.1 Design and Testing of Payload

Changes in Payload Design Since CDR

No physical changes have been made to the payload since the CDR. Code for the Arduino has been updated to use a different library and a calibration feature has been added. Programming of the altimeters has not been changed (will still deploy at apogee and at 500 ft).

Unique Features – Structural Elements

The payload structure is composed of two main components: a locking mechanism and an avionics sled. The locking mechanism is composed of a wooden outer and inner ring. The outer ring is epoxied to the body tube of the rocket which is fixed. The inner ring is composed of a three pronged cylinder which meshes with outer ring to create a rigid lock. A sheet of rubber is epoxied on top of the inner ring to create an airtight seal and a sheet of plywood is epoxied on top of that sheet of rubber to add rigidity to the rubber. An eyebolt is epoxied into the inner ring to attach to the shock cord and to open the avionics bay with ease. The sled was 3D printed using PLA plastic and has designated indentations for each major electrical component. This will be epoxied onto the inner ring of the locking mechanism.

Unique Features – Electrical Elements

All electrical components will be placed in the avionics bay in the designated slots for each electrical component. These components include two altimeters (RRC3 and SL100), an Arduino Uno, three batteries and their 3D printed battery holders, an MPU6050 module, and a BMP180 sensor. The two altimeters and Arduino Uno will be fastened onto a thin sheet of plywood using screws and will be epoxied onto the sled. This is to prevent damage to the modules and to be able to reuse them for future projects. The batteries will be secured using 3D printed 9V battery holders and will be epoxied onto the sled. The two data capturing devices (MPU6050 and BMP180) will have specially 3D printed case with foam inside of them. This case and foam will house the two modules. The case will then be epoxied onto the sled. Wiring and the use of switches is outlined in figures 4.2.1 and 4.2.2.

Construction

The payload is not completed, however, the Table 6.1.1 outlines what's been done and what needs to be done. Green text indicates what's been done and red text indicates what needs to be done.

Table 6.1.1: Construction Progress of Payload

Component	Manufacturing Stage
Coding/Programming	-Completed for the payload and altimeters
Wiring	-Completed wiring the payload components to each other -Wire the altimeters and batteries -Connect wires to switches -Use heat shrink tubing to organize wires
Locking mechanism	-All parts have been CNC'ed -All parts have been sanded and epoxied together -Need to epoxy the parts to the rocket and ensure everything work -Need to drill 2 holes into inner part of the locking mechanism for eyebolt and wires
Avionics Sled	-Prototype and final sled have been 3D printed -9V battery holders designed and printed -Need to place electronics on sled and screw them to their respective plywood sheets -Epoxy plywood sheets onto sled -Epoxy sled to locking mechanism
Testing Instruments	-BMP180 and MPU6050 have been tested and code has been updated for each instrument

Schematics of the As-Built Payload

Since the payload is not completed, schematics of as-built components are not available. However, the outer radius of the outer ring for the locking mechanism has been reduced from 3.9" to 3.75" due to sanding. This does not affect the dimensions of the avionics sled.

Discussion of Changes

The avionics sled differs from past models since it is now 0.1” longer than before to better accommodate all electronics on board. The avionics sled can’t exceed 11” due to limitations in 3D printer print bed size. The rest of the dimensions remain the same, despite changes to the locking mechanism. The locking mechanism has deviated from the original 3D model since the dimensions in the model did not account for offsets. The inner ring has been sanded down so that entry into the outer ring is smoother and easier without compromising the ability of the mechanism to lock. The bottom of the inner ring has been sanded down for the same reason mentioned before. The outer ring has been sanded from the outside to slide into the body tube easier and to allow space for epoxy to harden. This minimizes smearing when sliding the locking mechanism into the body tube.

7 Project Plan

7.1 Testing**

Table 7.1.1 and Table 7.1.2 highlight the tests we have completed and their results and the tests we still plan to do.

Table 7.1.1: Testing Methods and Results

	Test	Method	Result
1	Dropping the MPU6050 module	This module should accurately measure the acceleration of the rocket. This will be tested by getting the reading of the still module. The downward acceleration should be 9.8 m/s^2 or 1 g because objects are constantly under the force of gravity.	The module reads exactly 1 g when only placed under the force gravity.
2	Rotating the MPU6050 module	This module should also accurately the angular velocity of the rocket. This will be tested by rotating the module using a servo motor. The motor will be programmed to rotate at specific speeds.	This test has yet to be completed.
3	Refrigerating the BMP 180 module	This module should accurately measure the temperatures the rocket reaches at different altitudes. The sensor will be placed first in a refrigerator, and then in a freezer. A digital thermometer will also be placed with it, to have a reading to compare the data to.	The module was placed in a refrigerator at a temperature of 40 F. The module read 42 F. When placed in a freezer at a temperature of 3 F, the module read 10 F.
4	Elevating the BMP 180 module	This module should also accurately measure pressure and, thus, altitude. The sensor uses pressure to measure the altitude. By taking the module from the bottom to the top of a building with a known height, we can gauge its accuracy.	Using an online altitude reading, we found that the altitude at our location is 430 ft with an accuracy of 66 feet. The module read 445 ft, which is within the margin of error of the website reading. Additionally, the module recorded data

			points that increased by 10 ft when we rode to each floor of our building in the elevator.
5	Elevating the MissileWorks RRC3 altimeter	The altimeter should accurately measure altitude. The altimeter uses pressure to measure the altitude. By taking the module from the bottom to the top of a building with a known height, we can gauge its accuracy.	The altimeter read 267 ft initially and recorded data points that increased by 10 ft when we rode to each floor of our building in the elevator.
6	Elevating the StratoLogger altimeter	The altimeter should accurately measure altitude. The altimeter uses pressure to measure the altitude. By taking the module from the bottom to the top of a building with a known height, we can gauge its accuracy.	The altimeter read 453 ft initially and recorded data points that increased by 10 ft when we rode to each floor of our building in the elevator.
7	Applying force to bulkhead	The bulkheads need to be able to withstand the force of the deployment of the parachutes. By manufacturing a new bulkhead out of the same material, placing on it an eyebolt, and applying a force to it by tying it to an accelerating car or other vehicle, we can physically test how much force this structure can withstand.	This test has yet to be completed.
8	Testing of shear pins	To ensure that the ejection charges apply enough force to break the shear pins and release the parachutes, we are planning to use the extra carbon fiber tube to test the force of the charge.	This test has yet to be completed.
9	Integration testing	A mock run through of the launch will be run, where all components will be put together. This includes folding the parachute within the nose cone, inserting the avionics bay, and putting together the nose cone and body tubes. This will ensure that everything fits together after completing manufacturing	This test has yet to be completed.

		and that the rocket will be ready to launch two hours after set up.	

Table 7.1.2: Testing Success and Percent Error

Test	Success?	Percent Error
1	This test was a success. The module read 1 g when it wasn't moved, which is the acceleration it was experiencing due to gravity. There may be some discrepancy due to the actual accuracy of the module (as in lost data due to the amount of digits it outputs), but we're confident that it will be able to give similar numbers to the OpenRocket simulation.	0%
3	This test had conflicting data. It had 5% error when measuring the temperature of the fridge and 233% error when measuring the temperature of the freezer. According to the manufacturer, it should be able to function at this temperature, but it seems to lose accuracy the colder it gets.	Refrigerator – 5% Freezer – 233%
4	This test was a success. The module only had 3% error in its altitude reading and correctly recorded data points when we rode in the elevator. Each floor is about 10 ft in height and the altitude results reflected this.	3%
5	The altimeter was extremely off in its initial reading and was therefore off in its all data points. However, each data point had a correct difference of 10 ft which accurately reflected the height of each floor of the building. We discovered this was because the altimeter was not correctly calibrated and learned how to reprogram it correctly. Another test needs to be run to ensure the reading is now accurate.	37.9%
6	This test was a success. The altimeter only had 5.3% error in its reading and correctly recorded the change in altitude when riding in the elevator.	5.3%

From the tests we have completed, we learned how to properly program all of the modules and altimeters so they read accurate measurements. We also gained more in depth knowledge of what type of conditions they function best in, but these results will not be affected because our rocket will not encounter these environmental factors when in flight. From future tests, we will be able to confirm that the structure of our rocket will allow for a safe and successful flight. These tests are an extra precaution because past flights have already shown that our structure and overall design can withstand the forces during launch and descent.

7.2 Requirements Compliance**

Table 7.2.1 provides a description of how each requirement has been verified or will be verified.

Table 7.2.1: Verification of Requirements

	Requirement	Method	Plan
	General Requirements		
1	Students on the team will do 100% of the project.	Demonstration	In the past, rockets have all been 100% designed, manufactured, and tested by students on the team. Veteran members demonstrated to new members how this process is completed, ensuring that all team members were able to successfully complete their tasks.
2	The team will provide and maintain a project plan.	Demonstration	In all reports, a project plan is established. Subteams demonstrate their completed parts and progress in reports by describing their construction progress.
3	The team must identify all team members attending launch week activities by the time of the Critical Design Review (CDR).	Demonstration	Our team lead sent a list of members that have demonstrated their commitment to the project and were deemed worthy of attending the competition.
4	The team is strongly encouraged to engage in educational, hands-on science, technology, engineering, and mathematics (STEM) activities, as defined in the STEM Engagement Activity Report, by FRR.	Demonstration	Team members demonstrated that they hosted a STEM activity for young students through photographs taken at the event, as well as cute model rockets that the young students built.
5	Team leads will upload all deliverables to the WSGC grant management page by the deadline specified in this handbook for each milestone.	Demonstration	Our team lead demonstrated that all reports and deliverables were uploaded on time.
6	All deliverables must be in PDF format.	Demonstration	All reports were converted to PDF format upon completion.
7	Teams will utilize the provided templates for each report and virtual presentation.	Demonstration	Each report demonstrates that the templates were followed. They use the same presented sections and subsections, completed with the requested information.
8	The team will provide any computer equipment necessary to perform a video teleconference with the review panel.	Demonstration	Our team has demonstrated consistently that we are capable of providing this equipment as we have successfully presented the contents of our PDR and CDR to those with WSGC and FNL.
9	All teams will be required to use the launch pads provided by Tripoli	Demonstration	On launch day, our team will demonstrate that we will use the

	Wisconsin.		provided launch pads.
10	Each team must identify a “mentor.”	Demonstration	In each report, our team has identified Frank Nobile as our mentor.
11	All projects must be completely constructed (at least 90%) ready to fly at least two (2) weeks prior to launch date.	Inspection	An inspection of all completed rocket parts and our progress shows that our team is projected to have the vehicle completed 2 weeks prior to launch.
12	All projects must have a documented flight stable simulation profile.	Analysis	Flight simulation profiles were created for each iteration of our rocket design through the use of simulation software OpenRocket.
13	All projects mush have a picture slide show depicting construction of the motor mount and fin fillet assembly process submitted for safety inspection.	Demonstration	Team members involved in the construction of these parts demonstrated the construction with photos that will be used in the slide show.
	Vehicle Requirements		
1	The vehicle will deliver the payload to an apogee altitude between 2,400 and 3,000 feet above ground level (AGL).	Tribal requirement - NA	
2	The vehicle will deliver the payload to an apogee altitude between 3,500 and 5,000 feet above ground level (AGL).	Analysis	We are unable to run an actual test launch to verify that our vehicle will reach the required altitude. Thus, we analyzed our rocket design in OpenRocket and set conditions as close as possible to that of the actual launch day. This simulation confirmed that our projected altitude will be within competition guidelines.
3	Teams shall identify their target altitude goal at each design report milestone.	Analysis	Simulations run on OpenRocket with our latest vehicle design have provided an accurate target altitude that we should reach on launch day.
4	The vehicle will carry, at a minimum, one commercially available, barometric altimeter for recording the official altitude used in determining the Altitude Award winner.	Inspection	Two altimeters will be used to acquire altitude data within our rocket. The avionics bay will be inspected to esnure that the altimeters are in place and are functioning.
5	Each altimeter will be armed by a dedicated mechanical arming switch that is accessible from the exterior of the rocket airframe when the rocket is in the launch configuration on the launch pad.	Inspection	An inspection of the rocket shows that there are slits through which the arming switch will be accessible.
6	Each altimeter will have a dedicated power supply.	Inspection	An inspection of the avionics bay confirms that the two altimeters are wired to their own individual batteries.
7	Each arming switch will be capable of being locked in the ON position for	Demonstration	Electrical connectors are used as the switches that have demonstrated in past

	launch.		years to be strong enough to withstand the launch and remain in the on position.
8	The launch vehicle will be designed to be recoverable and reusable.	Testing	Based on past competitions, which we consider test launches because our current vehicle uses the same fundamental design, we can confirm that our rocket will be recoverable and reusable.
9	The launch vehicle will have a maximum of four (4) independent sections.	Inspection	An inspection of the vehicle shows that we only have 3 independent sections: the nosecone, the upper body tube, and the lower body tube.
10	The launch vehicle will be limited to a single stage.	Inspection	An inspection of the vehicle shows that our vehicle meets this requirement. This is further demonstrated in the OpenRocket simulations.
11	The launch vehicle will be capable of being prepared for flight at the launch site within 2 hours of the time the Federal Aviation Administration flight waiver opens.	Inspection	An inspection of our current vehicle and our construction progress show that we are projected to have the rocket completely finished by launch day. Thus, on launch day all we will have to do is prepare the motor, charges, and ensure the parachutes are correctly folded.
12	The launch vehicle will be capable of remaining in launch-ready configuration on the pad for a minimum of 2 hours without losing the functionality of any critical on-board components.	Testing	Once the vehicle is completed, we will be able to simulate launch day preparations and confirm that this requirement will be met.
13	The launch vehicle will be capable of being launched by a standard 12-volt direct current firing system.	Inspection	An inspection of the vehicle displays that our rocket contains all the proper structures to successfully launch with a standard DC firing system.
14	The launch vehicle will require no external circuitry or special ground support equipment to initiate launch.	Inspection	An inspection of the vehicle shows that the only external circuitry are the wires that we need access to to lock the arming switch to the on position.
15	The launch vehicle will use a commercially available solid motor propulsion system using ammonium perchlorate composite propellant (APCP) which is approved and certified by the National Association of Rocketry (NAR), and/or Tripoli Rocketry Association (TRA).	Demonstration	On launch day, our team will demonstrate that we will use the motors provided.
16	Pressure vessels on the vehicle will be approved by the RSO and will meet criteria set by FNL.	Our vehicle will not be using pressure vessels - NA	
17	The total impulse provided by an AISES launch vehicle will not exceed 5,120	Analysis	The simulation software OpenRocket confirmed that our vehicle meets this

	Newton-seconds (L-class) – 54mm.		requirement.
18	The launch vehicle will have a minimum static stability margin of 1.0 at the point of rail exit.	Analysis	The simulation software OpenRocket confirmed that our vehicle meets this requirement.
19	The launch vehicle will accelerate to a minimum velocity of 52 fps at rail exit.	Analysis	We are unable to run an actual test launch to verify that our vehicle will have the minimum stated rail exit velocity. Thus, we analyzed our rocket design in OpenRocket and set conditions as close as possible to that of the actual launch day. This simulation confirmed that our rocket will meet this minimum velocity..
20	All teams will successfully launch and recover an Estes rocket provided by WSGC.	Demonstration	A video of our launch that was uploaded to Facebook demonstrates that this task was completed.
21	AISES teams are highly recommended to successfully launch and recover a subscale model of their rocket prior to CDR.	NA	
22	Any structural protuberance on the rocket will be located aft of the burnout center of gravity.	Inspection	An inspection of the vehicle shows that the only protuberance are the fins, which are indeed located aft of the CG.
23	The team's name and launch day contact information shall be in or on the rocket airframe as well as in or on any section of the vehicle that separates during flight and is not tethered to the main airframe.	Inspection	An inspection of the vehicle shows that our contact information is indeed located in the rocket.
24	The Center of Gravity (CG) and Center of Pressure (CP) must be indicated on the exterior of the rocket, from simulation, using the fully loaded configuration prior to flight.	Inspection	An inspection of the vehicle shows that the CG and CP are indeed indicated on the exterior of the rocket.
25	Vehicle Prohibitions	Inspection	An inspection of the vehicle will quickly show that we did not use any of the prohibited items in our construction process. Additionally, we sent all materials to Frank Nobile to confirm that they are safe and allowed in the competition. Finally, simulations confirm that all aspects of the rocket's flight are within competition guidelines.
	Recovery System Requirements		
1	The launch vehicle will stage the deployment of its recovery devices, where a drogue parachute is deployed at apogee and a main parachute is deployed at a lower altitude.	Testing	The altimeters were tested to ensure they are functional and were probably programmed to deploy the parachutes at the proper altitudes.
2	Competition ejection charges will be provided by Tripoli Wisconsin at the	Demonstration	We will demonstrate at the competition that we are using the ejection charges

	event.		provided by Tripoli Wisconsin.
3	At landing, each independent section of the launch vehicle will have a maximum kinetic energy of 75 ft-lbf.	Analysis	We are unable to run an actual test launch to verify that our vehicle will not exceed the given kinetic energy. Thus, we analyzed our rocket design in OpenRocket and set conditions as close as possible to that of the actual launch day. This simulation confirmed that our rocket will have a kinetic energy lower than the set maximum upon landing.
4	The recovery system electrical circuits will be completely independent of any payload electrical circuits.	Inspection	Inspection of the avionics bay will confirm that the two altimeters will have their own independent power sources and are not wired to the electrical components to be used for the challenge.
5	All recovery electronics will be powered by commercially available batteries.	Inspection	Inspection of the avionics bay will confirm that we have two altimeters that will be used int he recovery system and that they are correctly wired to two different batteries.
6	The recovery system will contain at least one (although redundant is recommended), commercially available altimeter.	Inspection	Inspection of the avionics bay will confirm that we have two altimeters that will be used in the recovery system and that they are correctly wired to a power source.
7	Motor ejection is required backup deployment at apogee.	Inspection	We will be using the motors provided by the competition which should have this feature built in already.
8	Removable shear pins can be used for both the main parachute compartment and the drogue parachute compartment, but not required.	Inspection	This is not a requirment, but a quick inspection will confirm that we will be using shear pins in our rocket.
9	Recovery area will be limited to a 2,500-ft. radius from the launch pads.	Analysis	We are unable to run an actual test launch to verify that our vehicle will land within the given radius. Thus, we analyzed our rocket design in OpenRocket and set conditions as close as possible to that of the actual launch day. This simulation confirmed that our rocket will not veer off course that drastically.
10	Descent time will be limited to 90 seconds	Analysis	We are unable to run an actual test launch to verify that our vehicle will have a descent time of less than 90 seconds. Thus, we analyzed our rocket design in OpenRocket and set conditions as close as possible to that of the actual launch day. This simulation confirmed that our projected descent time will be within competition guidelines.

11	An electronic tracking device will be installed in the launch vehicle and will transmit the position of the tethered vehicle or any independent section to a ground receiver	This is an optional requirment. Our rocket does not contain a tracking device.	
12	The recovery system electronics will not be adversely affected by any other on-board electronic devices during flight	Testing	The recovery system electronics are not wired with any other electronics, nor are there any tracking devices that could potentially affect their function. This was confirmed by testing the altimeters in the presence of the microcontroller.
	Payload/Experiment Requirements		
	The AISES team rocket challenge will consist of designing a microcontroller system installed in a high-power rocket that can capture crucial data during flight.	Testing	The micro-controller was tested to ensure that at least 3 data types will be taken for successful completion of the challenge.
	Safety Requirements		
1	Each team will use a launch and safety checklist.	Analysis	An analysis of all safety hazards was completed by our safety officer to develop check lists to be completed for a safe launch.
2	Each team must identify a student safety officer.	Demonstration	A team member that demonstrated a passion for the safety of the team during the design, manufacturing, and testing of the rocket was selected to be the safety officer prior to the submission of the proposal.
3	The role and responsibilities of each safety officer will include duties defined by FNL.	Inspection	The safety officer was present at all meetings to ensure that proper procedures were followed through inspection of team member actions and the state of the environment.
4	During test flights, teams will abide by the rules and guidance of the local rocketry club's RSO.	Our team did not conduct a test flight - NA	
5	Teams will abide by all rules set forth by the FAA.	Inspection	The safety officer was present at all meetings to ensure that all rules set by the FAA were followed through inspection of team member actions and the state of the environment.
6	For proof of construction and a safe flight, photographs/video should be made during the construction process.	Demonstration	Photographs demonstrate that construction was completed safely.
7	All projects must have a minimum of two (2) virtual inspections with the WSGC Technical Advisor, prior to (to coincide with) Flight Readiness Review.	Demonstration	This will be completed by demonstrating to WSGC our constructed rocket.

7.3 Project Budget

Table 7.3.1 outlines components needed by subteams with respective totals, adding up to the full budget total. It also includes funds required for travel to and from the competition.

Table 7.3.1: Budget of all team expenses

UCLA Bearospace

2018-2019 Proposed Budget

	Expense	Company	Projected Units	Projected Unit Price	Projected Total Price
Structures	***Totals:***				**$695**
	Body Tube	Public Missiles	1	$250	$250
	Coupler	Public Missiles	1	$50	$50
	Fiberglass	TAP Plastics	1	$150	$150
	Motor Mount & Ring/Epoxy	Apogee Components	1	$100	$100
	Wood Sheets	McMaster	1	$65	$65
	Carbon Fiber Sheets	RockWest Composites	1	$60	$60
	Screws	McMaster	1	$20	$20
Electrical	***Totals:***				**$112**
	RRC3 Sport Altimeter	Missile Works	1	$70	$70
	SR44 Silver Oxide Battery	Amazon	2	$6	$11
	Battery Cell Holders (N-type)	Newark	2	$1	$2
	MPU6050 3 Axis Accelerometer (	Amazon	1	$5	$5
	SD Card Player Modules (x5)	Amazon	1	$6	$6
	Arduino Uno	Amazon	1	$17	$17
Tools	***Totals:***				**$137**
	Dremel Rotary Tool & Kit	Dremel/Amazon/HD	1	$130	$130
	Dremel Blades	Home Depot	1	$7	$7
Safety	***Totals:***				**$146**
	Gloves (100 pack)	Fisher Scientific	1	$31	$31
	Masks	Fisher Scientific	4	$15	$60
	Goggles		4	$9	$35
	Lab coats		2	$10	$20
Travel	***Totals:***				**$2,110**
	Toolbox	Arline	1	$25	$25
	Rocket Box	Airline	1	$25	$25
	Uber to LAX	Uber	1	$25	$25
	Plane Tickets (Round Trip)	Airline	6	$275	$1,650
	Baggage Fees	Airline	1	$25	$25
	Bus tickets	Coach USA	6	$50	$300
	Uber to hotel	Uber	1	$20	$20
	Uber to bus stop	Uber	1	$20	$20
	Uber to UCLA	Uber	1	$20	$20
	Grand Total				**$3,200**

Table 7.3.2 cointains our current list of funding sources, with respective means of access and fiscal amounts. This listing accounts for both past sources and more recent acquisitions.

Table 7.3.2: Funding Sources for 2018-2019.

Funding Source	**Funding Access**	**Amount**
Wisconsin Space Grant Consortium (WSGC)	Reimbursements for Materials and Supplies	$3000
Previous Award Money	Purchase Orders Through the UCLA Engineering Department	$575
UCLA Engineering Alumni Association (EAA)	Purchase Orders Through the UCLA Engineering Department	$650 (materials and supplies only)
UCLA Student Organizations, Leadership & Engagement Office (SOLE)	Purchase Orders Through the UCLA Community Activities Committee (CAC) Leadership Development Fund	$1850 (travel only)
Total		**$6075**

8 Appendix

Material Safety Data Sheets…57

- Clear Epoxy Resin
- Graphite Powder
- GREAT STUFF Gaps & Cracks Insulating Foam
- Klean-Strip Acetone
- STRUST +SSPR 6PK GLOSS BLACK
- TAP Super Hard Epoxy Hardener
- TAP Super Hard Epoxy Resin
- WD-40

SAFETY DATA SHEET

Issuing Date 28-Oct 2014 **Revision Date** 17-Oct-2014 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product SDS Name **Clear Epoxy Resin – Syringe – Part A**

J-B Weld FG SKU Part Numbers Covered

50112, 50101, 50132, 50112-F, 50101-F, 50132-F, 80112, 40002

J-B Weld Product Names Covered

ClearWeld™ (all), PlasticWeld™ Syringe, MinuteWeld™ Syringe, Wood Restore™ Liquid Epoxy

J-B Weld Product Type

Epoxy

Recommended use of the chemical and restrictions on use

Recommended Use	General Purpose Adhesive
Uses advised against	No information available

Details of the supplier of the safety data sheet

Supplier Name	J-B WELD COMPANY,LLC
Supplier Address	1130 COMO ST SULPHUR SPRINGS, TX 75482 USA
Emergency Telephone Numbers	Transportation Emergencies: Chemtrec (24 hour transportation emergency response info): 800-424-9300 or 703-527-3887 Poison/Medical Emergencies: Poison Control Centers (24 hour emergency poison / medical response info): 800-222-1222
Supplier Email	info@jbweld.com
Supplier Phone Number	903-885-7696

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 1
Skin sensitization	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Warning**

Hazard Statements

Causes severe skin irritation

May cause an allergic skin reaction

May cause serious eye damage / eye irritation

Appearance Clear **Physical State** Gel Liquid **Odor** Ammoniacal

Precautionary Statements - Prevention

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves

Precautionary Statements - Response

Immediately call a doctor/physician or poison control center.
Specific treatment (see supplemental first aid instructions on this label)

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a doctor/physician

Skin

Call a POISON CENTER or doctor/physician if you feel unwell
Wash contaminated clothing before reuse
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation or rash occurs: Get medical advice/attention

Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Do NOT induce vomiting
Precautionary Statements - Storage
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable

Unknown Toxicity
75% of the mixture consists of ingredient(s) of unknown toxicity

Other information

Harmful to aquatic life with long lasting effects
Repeated or prolonged skin contact may cause allergic reactions with susceptible persons

Interactions with Other Chemicals
Use of alcoholic beverages may enhance toxic effects.

3. COMPOSITION/INFORMATION ON INGREDIENTS

.

Chemical Name	CAS No	Weight-%
Diglycidyl bisphenol A resin	25085-99-8	95
Oxirane, [[4-(1,1-dimethylethyl)phenoxy]methyl]-	3101-60-8	5

4. FIRST AID MEASURES

· **4.1 Description of first aid measures**
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly.
Immediately remove any clothing soiled by the product. If skin irritation continues, consult a doctor.
· **After eye contact:**
Protect unharmed eye.
Rinse opened eye for several minutes under running water. Then consult a doctor. Do not remove contact lenses if worn.

· **After swallowing:**
Rinse out mouth and then drink plenty of water.
Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed** Allergic reactions
Nausea
Dizziness
· **Hazards** Danger of impaired breathing.
· **4.3 Indication of any immediate medical attention and special treatment needed**
Treat skin and mucous membrame with antihistamine and corticoid preparations.
Monitor circulation.

5. FIRE-FIGHTING MEASURES

· **5.1 Extinguishing media**
· **Suitable extinguishing agents:** Use fire extinguishing methods suitable to surrounding conditions.
· **5.2 Special hazards arising from the substance or mixture**
Formation of toxic gases is possible during heating or in case of fire.
· **5.3 Advice for firefighters**
· **Protective equipment:**
Wear self-contained respiratory protective device.
Wear fully protective suit.
· **Additional information** Cool endangered receptacles with water spray.

6. ACCIDENTAL RELEASE MEASURES

· **6.1 Personal precautions, protective equipment and emergency procedures**
Use respiratory protective device against the effects of fumes/dust/aerosol.
Remove persons from danger area.
Ensure adequate ventilation
Wear protective equipment. Keep unprotected persons away.
· **6.2 Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **6.3 Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Clean the affected area carefully; suitable cleaners are:
Warm water and cleansing agent
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment. See Section 13 for disposal information.

7. HANDLING AND STORAGE

· **7.1 Precautions for safe handling**
Ensure good ventilation/exhaustion at the workplace.
Prevent formation of aerosols.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**

· **Storage:**

· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:**
Store away from oxidizing agents.
Store away from foodstuffs.
Do not store together with acids.
· **Further information about storage conditions:** Store in cool, dry conditions in well sealed receptacles.
· **7.3 Specific end use(s)** No further relevant information available.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**
· **Ingredients with limit values that require monitoring at the workplace:**
The product does not contain any relevant quantities of materials with critical values that have to be monitored at the workplace.
· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
Avoid contact with the eyes and skin.
· **Respiratory protection:**
Use suitable respiratory protective device in case of insufficient ventilation.
Use suitable respiratory protective device when aerosol or mist is formed.

· **Protection of hands:**


Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
Butyl rubber, BR
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material cannot be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**


Safety glasses

Goggles recommended during refilling

9. PHYSICAL AND CHEMICAL PROPERTIES

· **9.1 Information on basic physical and chemical properties** · **General Information**	
· **Appearance:**	
Form:	Liquid
Colour:	Light yellow
· **Odour:**	Characteristic
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	> 200°C (> 392 °F)
· **Flash point:**	> 93,3°C (> 200 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	
Decomposition temperature:	Not determined.
· **Self-igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.

· **Vapour pressure:**	Not determined.
· **Density at 20°C:**	1,13 g/cm³
· **Relative density**	Not determined. ·
Vapour density	Not determined.
· **Evaporation rate**	Not determined.
· **Solubility in/Miscibility with water:**	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not determined.
Kinematic:	Not determined.
· **VOC (% content)**	<1%
Dynamic:	Not determined.
· **9.2 Other information**	No further relevant information available.

10. STABILITY AND REACTIVITY

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:**
No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions**
Reacts with oxidizing agents.
Reacts with amines.
Exothermic polymerization.
· **10.4 Conditions to avoid** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:** Carbon monoxide and carbon dioxide

11. TOXICOLOGY INFORMATION

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Irritating effect.
· **Sensitization:**
Sensitization possible through skin contact.
Sensitizing effect through inhalation is possible by prolonged exposure.

· **Additional toxicological information:**

The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant

12. ECOLOGICAL INFORMATION

· **12.1 Toxicity**

· **Aquatic toxicity:** The product contains materials that are harmful to the environment.

· **12.2 Persistence and degradability:** The product is not easily, but potentially degradable.

· **12.3 Bioaccumulative potential**

Due to the distribution coefficient n-octanol/water an accumulation in organisms is possible.

· **12.4 Mobility in soil** No further relevant information available.

· **Additional ecological information:**

· **General notes:**

Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.

· **12.5 Results of PBT and vPvB assessment**

· **PBT:** Not applicable.

· **vPvB:** Not applicable.

· **12.6 Other adverse effects:** No further relevant information available.

13. DISPOSAL CONSIDERATIONS

· **13.1 Waste treatment methods**

· **Recommendation**

Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Can be burned with household garbage after consulting with the waste disposal facility operator and the pertinent authorities and adhering to the necessary technical regulations.

· **Uncleaned packaging:**

· **Recommendation:** Disposal must be made according to official regulations.

14. TRANSPORT INFORMATION

· **14.1 UN-Number**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.2 UN proper shipping name**	
· **DOT, ADR, ADN, IMDG, IATA**	Not Regulated
· **14.3 Transport hazard class(es)**	
· **DOT, ADR, ADN**	
· **Class**	Not Regulated

· **IMDG, IATA** 	
· **Class**	Not Regulated
· **14.4 Packing group**	
· **DOT, ADR, IMDG, IATA**	Not Regulated
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	Not Regulated
· **Special marking (IATA):**	Not applicable.
· **14.6 Special precautions for user**	Not applicable.
· **14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **UN "Model Regulation":**	-

15. REGULATORY INFORMATION

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **United States (USA)**
· **SARA**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.
· **Section 313 (Specific toxic chemical listings):**
None of the ingredients is listed.
· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65 (California):**

· **Chemicals known to cause cancer:**	
None of the ingredients is listed.	
· **Chemicals known to cause reproductive toxicity for females:**	
None of the ingredients is listed.	
· **Chemicals known to cause reproductive toxicity for males:**	
None of the ingredients is listed.	

· **Chemicals known to cause developmental toxicity:**
None of the ingredients is listed.

· **Carcinogenic Categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.

· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.
· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.
· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.
· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

· **Canada**

· **Canadian Domestic Substances List (DSL)**
All ingredients are listed.
· **Canadian Ingredient Disclosure list (limit 0.1%)**
None of the ingredients is listed.
· **Canadian Ingredient Disclosure list (limit 1%)**
None of the ingredients is listed.

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16. OTHER INFORMATION

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Relevant phrases**

H315: Causes skin irritation.
H317: May cause an allergic skin reaction.
H319: Causes serious eye irritation.
H341: Suspected of causing genetic defects.
H411: Toxic to aquatic life with long lasting effects.

R36/38: Irritating to eyes and skin.
R38: Irritating to skin.
R43: May cause sensitisation by skin contact.
R46: May cause heritable genetic damage. R51: Toxic to aquatic organisms.

· **Abbreviations and acronyms:**

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of Safety Data Sheet

SAFETY DATA SHEET

Issuing Date 27-Oct 2014 **Revision Date** 17-Oct-2014 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product SDS Name **Clear Epoxy Hardener - Syringe - Part B**

J-B Weld FG SKU Part Numbers Covered

50112, 80112, 50112-F

J-B Weld Product Names Covered

ClearWeld™ (all)

J-B Weld Product Type

Epoxy

Recommended use of the chemical and restrictions on use

Recommended Use	General Purpose Adhesive
Uses advised against	No information available

Details of the supplier of the safety data sheet

Supplier Name	J-B WELD COMPANY,LLC
Supplier Address	1130 COMO ST SULPHUR SPRINGS, TX 75482 USA
Emergency Telephone Numbers	Transportation Emergencies: Chemtrec (24 hour transportation emergency response info): 800-424-9300 or 703-527-3887 Poison/Medical Emergencies: Poison Control Centers (24 hour emergency poison / medical response info): 800-222-1222
Supplier Email	info@jbweld.com
Supplier Phone Number	903-885-7696

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin corrosion/irritation	Category 1B
Serious eye damage/eye irritation	Category 1
Skin sensitization	Category 1

GHS Label elements, including precautionary statements

Emergency Overview

Signal word **Warning**

Hazard Statements

Causes severe skin irritation

May cause serious eye damage / eye irritation

May cause an allergic skin reaction

Appearance Pale yellow **Physical State** Gel Liquid **Odor** Ammoniacal

Precautionary Statements - Prevention

Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves

Precautionary Statements - Response

Immediately call a POISON CENTER or doctor/physician
Specific treatment (see supplemental first aid instructions on this label)

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
Immediately call a POISON CENTER or doctor/physician

Skin

Call a POISON CENTER or doctor/physician if you feel unwell
Wash contaminated clothing before reuse
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
If skin irritation or rash occurs: Get medical advice/attention

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Do NOT induce vomiting
Precautionary Statements - Storage
Store locked up

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable

Unknown Toxicity
75% of the mixture consists of ingredient(s) of unknown toxicity

Other information

Harmful to aquatic life with long lasting effects
Repeated or prolonged skin contact may cause allergic reactions with susceptible persons

Interactions with Other Chemicals
Use of alcoholic beverages may enhance toxic effects.

3. COMPOSITION/INFORMATION ON INGREDIENTS

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Chemical Name	CAS No	Weight-%
2,4,6-Tri(dimethylaminomethyl)phenol	90-72-2	7 - 13
1-(2-Aminoethyl) piperazine	140-31-8	<5%
Benzyl alcohol	100-51-6	3 - 5
Ethylbenzene	100-41-4	<1%

4. FIRST AID MEASURES

First aid measures

General Advice

Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area. Seek immediate medical attention/advice. Remove contact lenses, if present and easy to do. Continue rinsing.

Skin Contact

Immediate medical attention is required. Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. May cause an allergic skin reaction.

Inhalation

Remove to fresh air. Get medical attention immediately if symptoms occur. If breathing is difficult, (trained personnel should) give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation.

Ingestion Do NOT induce vomiting. Rinse mouth immediately and drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.

Self-protection of the first aider Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Use personal protective equipment as required. Wear personal protective clothing (see section 8). Avoid breathing vapors or mists. Avoid contact with skin, eyes or clothing.

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Burning sensation. Coughing and/ or wheezing. Difficulty in breathing. Itching. Rashes. Hives.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure. May cause sensitization of susceptible persons.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media
CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical
The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating gases and vapors. Product is or contains a sensitizer. May cause sensitization by skin contact.

Uniform Fire Code Combustible Liquid: III-B
Sensitizer: Liquid

Hazardous Combustion Products
Carbon oxides.

Explosion Data
Sensitivity to Mechanical Impact No. **Sensitivity**

to Static Discharge No.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Attention! Corrosive material. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Avoid breathing vapors or mists. Avoid generation of dust.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental Precautions

Environmental Precautions

Refer to protective measures listed in Sections 7 and 8. Prevent further leakage or spillage if safe to do so. Should not be released into the environment. Do not allow to enter into soil/subsoil. Prevent product from entering drains.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling

Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Avoid breathing vapors or mists. Use only with adequate ventilation and in closed systems. In case of insufficient ventilation, wear suitable respiratory equipment. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture. Store locked up. Keep out of the reach of children. Store away from other materials.

Incompatible Products Acids. Bases. Oxidizing agent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Ethylbenzene 100-41-4	TWA: 20 ppm	TWA: 100 ppm TWA: 435 mg/m^3 (vacated) TWA: 100 ppm (vacated) TWA: 435 mg/m^3 (vacated) STEL: 125 ppm (vacated) STEL: 545 mg/m^3	IDLH: 800 ppm TWA: 100 ppm TWA: 435 mg/m^3 STEL: 125 ppm STEL: 545 mg/m^3

Other Exposure Guidelines See section 15 for national exposure control parameters

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations

Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection	Tight sealing safety goggles. Face protection shield.
Skin and Body Protection	Wear protective gloves and protective clothing. Long sleeved clothing. Chemical resistant apron. Impervious gloves.
Respiratory Protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse. Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. For environmental protection, remove and wash all contaminated protective equipment before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Gel Liquid		
Appearance	Pale yellow	**Odor**	Ammoniacal
Color	No information available	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	UNKNOWN	None known
Melting / freezing point	No data available	None known
Boiling point / boiling range	100 °C / 212 °F	None known
Flash Point	140 C / 284 F	None known
Evaporation Rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limit in Air		
Upper flammability limit	No data available	
Lower flammability limit	No data available	
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	No data available	None known
Water Solubility	Miscible in water	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	400	None known
Explosive properties	No data available	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	<1%
Particle Size	No data available
Particle Size Distribution	

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Hazardous Polymerization
Hazardous polymerization does not occur.

Conditions to avoid
Exposure to air or moisture over prolonged periods. Excessive heat.

Incompatible materials
Acids. Bases. Oxidizing agent.

Hazardous Decomposition Products
Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation

Specific test data for the substance or mixture is not available. Corrosive by inhalation. (based on components). Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Inhaled corrosive substances can lead to a toxic edema of the lungs. Pulmonary edema can be fatal. May cause irritation of respiratory tract. Harmful by inhalation.

Eye Contact

Specific test data for the substance or mixture is not available. Causes burns. (based on components). Corrosive to the eyes and may cause severe damage including blindness. Causes serious eye damage. May cause irreversible damage to eyes.

Skin Contact

Specific test data for the substance or mixture is not available. Corrosive. (based on components). Causes burns. May be absorbed through the skin in harmful amounts. Harmful in contact with skin.

Ingestion

Specific test data for the substance or mixture is not available. Causes burns. (based on components). Ingestion causes burns of the upper digestive and respiratory tracts. May cause severe burning pain in the mouth and stomach with vomiting and diarrhea of dark blood. Blood pressure may decrease. Brownish or yellowish stains may be seen around the mouth. Swelling of the throat may cause shortness of breath and choking. May cause lung damage if swallowed. May be fatal if swallowed and enters airways. Ingestion may cause irritation to mucous membranes. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea. May be harmful if swallowed.

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50

2,4,6-Tri(dimethylaminomethyl)phen ol 90-72-2	= 1000 mg/kg (Rat)	= 1280 mg/kg (Rat)	-
1-(2-Aminoethyl) piperazine 140-31-8	= 2140 mg/kg (Rat)	= 880 µL/kg (Rabbit)	-
Benzyl alcohol 100-51-6	= 1230 mg/kg (Rat)	= 2 g/kg (Rabbit)	= 8.8 mg/L (Rat) 4 h
Ethylbenzene 100-41-4	= 3500 mg/kg (Rat)	= 15354 mg/kg (Rabbit)	= 17.2 mg/L (Rat) 4 h

Information on toxicological effects

Symptoms Erythema (skin redness). Burning. May cause blindness. Coughing and/ or wheezing. Itching. Rashes. Hives.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization May cause sensitization of susceptible persons. May cause sensitization by skin contact. May cause sensitization by inhalation.

Mutagenic Effects No information available.

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Chemical Name	ACGIH	IARC	NTP	OSHA
Ethylbenzene 100-41-4	A3	Group 2B		X

ACGIH (American Conference of Governmental Industrial Hygienists)
A3 - Animal Carcinogen
IARC (International Agency for Research on Cancer)
Group 2B - Possibly Carcinogenic to Humans
OSHA (Occupational Safety and Health Administration of the US Department of Labor)
X - Present

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.

Chronic Toxicity Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen. Contains a known or suspected carcinogen.

Target Organ Effects Respiratory system. Eyes. Skin. Gastrointestinal tract (GI). Central Nervous System (CNS).

Aspiration Hazard No information available.

Numerical measures of toxicity Product Information

The following values are calculated based on chapter 3.1 of the GHS document

ATEmix (oral)
728.00 mg/kg
ATEmix (dermal)
1,140.00 mg/kg (ATE)
ATEmix (inhalation-gas)
18,750.00 ppm (4 hr)
ATEmix (inhalation-dust/mist)
6.20 mg/l
ATEmix (inhalation-vapor)
46.00 ATEmix

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic life with long lasting effects.

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
1-(2-Aminoethyl) piperazine 140-31-8	72h EC50: = 495 mg/L (Pseudokirchneriella subcapitata)	96h LC50: > 1000 mg/L (Poecilia reticulata) 96h LC50: >= 100 mg/L (Oncorhynchus mykiss) 96h LC50: 1950 - 2460 mg/L (Pimephales promelas)	EC50 > 10000 mg/L 17 h	48h EC50: = 32 mg/L
Benzyl alcohol 100-51-6	3h EC50: = 35 mg/L (Anabaena variabilis)	96h LC50: = 10 mg/L (Lepomis macrochirus) 96h LC50: = 460 mg/L (Pimephales promelas)	EC50 = 50 mg/L 5 min EC50 = 63.7 mg/L 15 min EC50 = 63.7 mg/L 5 min EC50 = 71.4 mg/L 30 min	48h EC50: = 23 mg/L
Ethylbenzene 100-41-4	72h EC50: = 4.6 mg/L (Pseudokirchneriella subcapitata) 96h EC50: > 438 mg/L (Pseudokirchneriella subcapitata) 72h EC50: 2.6 - 11.3 mg/L (Pseudokirchneriella subcapitata) 96h EC50: 1.7 - 7.6 mg/L (Pseudokirchneriella subcapitata)	96h LC50: 11.0 - 18.0 mg/L (Oncorhynchus mykiss) 96h LC50: = 4.2 mg/L (Oncorhynchus mykiss) 96h LC50: 7.55 - 11 mg/L (Pimephales promelas) 96h LC50: = 32 mg/L (Lepomis macrochirus) 96h LC50: 9.1 - 15.6 mg/L (Pimephales promelas) 96h LC50: = 9.6 mg/L (Poecilia reticulata)	EC50 = 9.68 mg/L 30 min EC50 = 96 mg/L 24 h	48h EC50: 1.8 - 2.4 mg/L

Persistence and Degradability

No information available.

Bioaccumulation

No information available

Chemical Name	Log Pow
1-(2-Aminoethyl) piperazine 140-31-8	-1.48
Benzyl alcohol 100-51-6	1.1
Ethylbenzene 100-41-4	3.118

Other adverse effects

No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal methods

This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging

Dispose of contents/containers in accordance with local regulations.

Chemical Name	RCRA	RCRA - Basis for Listing	RCRA - D Series Wastes	RCRA - U Series Wastes
Ethylbenzene 100-41-4		Included in waste stream: F039		

California Hazardous Waste Codes 331

Chemical Name	California Hazardous Waste
Ethylbenzene 100-41-4	Toxic Ignitable

14. TRANSPORT INFORMATION

DOT NOT REGULATED
Proper Shipping Name NON REGULATED
Hazard Class N/A

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated
Proper Shipping Name NON REGULATED
Hazard Class N/A

IMDG/IMO Not regulated
Hazard Class N/A

RID Not regulated

ADR Not regulated

ADN Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	All components are listed either on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical Name	CAS No	Weight-%	SARA 313 - Threshold Values %
Ethylbenzene - 100-41-4	100-41-4	1 - 5	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Ethylbenzene 100-41-4	1000 lb	X	X	X

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Ethylbenzene 100-41-4	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals.

Chemical Name	California Proposition 65
Ethylbenzene - 100-41-4	Carcinogen

U.S. State Right-to-Know Regulations

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Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
1-(2-Aminoethyl) piperazine 140-31-8	X	X	X		
Benzyl alcohol 100-51-6		X	X		
Ethylbenzene 100-41-4	X	X	X	X	X

International Regulations

Mexico National occupational exposure limits

Component	Carcinogen Status	Exposure Limits
Ethylbenzene 100-41-4 (1 - 5)		Mexico: TWA 100 ppm Mexico: TWA 435 mg/m^3 Mexico: STEL 125 ppm Mexico: STEL 545 mg/m^3

Mexico - Occupational Exposure Limits - Carcinogens

Canada

WHMIS Hazard Class

D2A - Very toxic materials

D2B - Toxic materials

16. OTHER INFORMATION

NFPA	**Health Hazards** 3	**Flammability** 1	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazards** 3 *	**Flammability** 1	**Physical Hazard** 0	**Personal Protection** X

Chronic Hazard Star Legend * = Chronic Health Hazard

Prepared By J-B Weld Company

Revision Date 17-Oct-2014
Revision Note No information available

Notice to reader

NON-WARRANTY: The information presented in this publication is based upon the research and experience of J-B Weld Company. No representation or warranty is made, however, concerning the accuracy or completeness of the information presented in this publication. J-B Weld Company makes no warranty or representation of any kind, express or implied, including without limitation any warranty of merchantability or fitness for any particular purpose, and no warranty or representation shall be implied by law or otherwise. Any products sold by J-B Weld Company are not warranted as suitable for any particular purpose to the buyer. The suitability of any products for any purpose particular to the buyers is for the buyer to determine. J-B Weld Company assumed no responsibility for the selection of products suitable to the particular purposes of any particular buyer. J-B Weld Company shall in no event be liable for any special, incidental, or consequential damages.

End of Safety Data Sheet

SAFETY DATA SHEET

Issuing Date 12-Jan-2016 **Revision Date** 26-Jul-2016 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS product identifier

Product Name **Graphite Powder**

Other means of identification

Product Code(s) **MZ-2, MZ-2H, MZ-5, MZ-21, MZ-25**

Synonyms Graphite Powder

Recommended use of the chemical and restrictions on use

Recommended Use Extra Fine Graphite AGS Extra Fine Graphite is the finest all-purpose, dry powder lubricant which is both odorless and non-toxic. Use to guard against sticking, wear, and corrosion. Can be used year-round on all types of material, including metal, wood, plastic, and rubber. Suggested applications: precision instruments, locks, hinges, tools, guns, fishing reels, camera shutters, bicycles, office machines, toys, and other fine mechanisms.

Uses advised against No information available

Supplier's details

Supplier Address
AGS Company
P.O. Box 729
Muskegon, MI
49443
TEL: 800-253-0403

Emergency telephone number

Emergency Telephone Number 800-255-3924

2. HAZARDS IDENTIFICATION

Classification

This product is considered hazardous by the OSHA Hazard Communication Standard 2012 (29 CFR 1910.1200).

Carcinogenicity	Category 1A

GHS Label elements, including precautionary statements

Emergency Overview

Signal Word **Danger**

Hazard Statements

• May cause cancer

Appearance Black. **Physical State** Solid/Powder. **Odor** None.

Precautionary Statements

Prevention

• Obtain special instructions before use.
• Do not handle until all safety precautions have been read and understood.
• Use personal protective equipment as required.

General Advice

• If exposed or concerned: Get medical attention/advice

Storage

• Store locked up.

Disposal

• Dispose of contents/container to an approved waste disposal plant.

Hazard Not Otherwise Classified (HNOC)

Not applicable.

Other information

Contact with dust may cause mechanical irritation of the eyes and skin. Inhalation of dust may cause irritation of the respiratory tract.

15% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms Graphite Powder

Chemical Name	CAS-No	Weight %	Trade secret
Quartz silica	14808-60-7	1-5	*

**The exact percentage (concentration) of composition has been withheld as a trade secret.*

4. FIRST AID MEASURES

Description of necessary first-aid measures

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

Skin Contact Wash skin with soap and water.

Inhalation Move to fresh air.

Ingestion Clean mouth with water and afterwards drink plenty of water.

Most important symptoms/effects, acute and delayed

Most Important Symptoms/Effects No information available.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media No information available.

Specific Hazards Arising from the Chemical
No information available.

Explosion Data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Ensure adequate ventilation.

Environmental Precautions

Environmental Precautions See Section 12 for additional Ecological Information.

Methods and materials for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

Incompatible Products None known based on information supplied.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH

Quartz silica 14808-60-7	TWA: 0.025 mg/m³ respirable fraction	(vacated) TWA: 0.1 mg/m³ respirable dust : (30)/(%SiO2 + 2) mg/m³ TWA total dust : (250)/(%SiO2 + 5) mppcf TWA respirable fraction : (10)/(%SiO2 + 2) mg/m³ TWA respirable fraction	IDLH: 50 mg/m³ respirable dust TWA: 0.05 mg/m³ respirable dust

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection None required for consumer use. Risk of contact, wear: Safety glasses with side-shields.
Skin and Body Protection None required for consumer use. Repeated or prolonged contact: Gloves should be worn.
Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State Solid/Powder.
Appearance Black.
Odor None.
Odor Threshold No information available.

Property	Values	Remarks/ - Method
pH	No data available	None known
Melting Point/Range	3652 °C	None known
Boiling Point/Boiling Range	No data available	None known
Flash Point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	No data available	None known
Specific Gravity	2.26	None known
Water Solubility	Insoluble in water.	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known

Flammable Properties Not flammable

Explosive Properties No data available
Oxidizing Properties No data available

Other information

VOC Content (%) No data available

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization

Hazardous polymerization does not occur.

Conditions to avoid

None known based on information supplied.

Incompatible materials

None known based on information supplied.

Hazardous decomposition products

None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information There is no data available for this product
Inhalation There is no data available for this product. Product dust may cause irritation of respiratory tract.
Eye Contact There is no data available for this product.
Skin Contact There is no data available for this product.
Ingestion There is no data available for this product.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Quartz silica	= 500 mg/kg (Rat)	-	-

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms No information available.

Delayed and immediate effects and also chronic effects from short and long term exposure

Sensitization No information available.
Mutagenic Effects No information available.
Carcinogenicity This product contains crystalline silica (quartz) in a non-respirable form. Inhalation of crystalline silica is unlikely to occur from exposure to this product.

Chemical Name	ACGIH	IARC	NTP	OSHA
Quartz silica	A2	Group 1	Known	X

Legend:

ACGIH: (American Conference of Governmental Industrial Hygienists)
A2 - Suspected Human Carcinogen

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans

NTP: (National Toxicity Program)
Known - Known Carcinogen

OSHA: (Occupational Safety & Health Administration)
X - Present

Reproductive Toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Aspiration Hazard	No information available.

Numerical measures of toxicity - Product

Acute Toxicity	15% of the mixture consists of ingredient(s) of unknown toxicity.

12. ECOLOGICAL INFORMATION

Ecotoxicity
The environmental impact of this product has not been fully investigated.

Persistence and Degradability	No information available.
Bioaccumulation	No information available.

Other Adverse Effects
No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.
Contaminated Packaging	Do not re-use empty containers.

14. TRANSPORT INFORMATION

DOT	Not regulated
ICAO	Not regulated
IMDG/IMO	Not regulated

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65
This product may contain substance(s) which are known to the State of California to cause cancer or reproductive harm.

Chemical Name	CAS-No	California Prop. 65
Quartz silica	14808-60-7	Carcinogen

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Quartz silica	X	X	X		

U.S. EPA Label Information
EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

NFPA	**Health Hazard** 1	**Flammability** 0	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard** 1	**Flammability** 0	**Physical Hazard** 0	**Personal Protection** X

Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501
Issuing Date 12-Jan-2016
Revision Date 26-Jul-2016
Revision Note Change to classification.

General Disclaimer
The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

SAFETY DATA SHEET
Klean-Strip Acetone

Revision: 05/24/2017
Supersedes Revision: 04/15/2015

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: Klean-Strip Acetone

Company Name: W. M. Barr
2105 Channel Avenue
Memphis, TN 38113

Phone Number: (901)775-0100

Web site address: www.wmbarr.com

Emergency Contact: 3E 24 Hour Emergency Contact (800)451-8346
Information: W.M. Barr Customer Service (800)398-3892

Intended Use: Paint, stain, and varnish thinning.

Product Code: CAC18, DAC18, GAC18, GAC182, QAC18, QAC184, PA12270, GAC18HDQP, GAC18HDWS, GAC18P, PAC181

2. HAZARDS IDENTIFICATION

Flammable Liquids, Category 2
Serious Eye Damage/Eye Irritation, Category 2
Specific Target Organ Toxicity (single exposure), Category 3

GHS Signal Word: **Danger**

GHS Hazard Phrases:
H225: Highly flammable liquid and vapor.
H319: Causes serious eye irritation.
H335: May cause respiratory irritation.
H336: May cause drowsiness or dizziness.

GHS Precaution Phrases:
P233: Keep container tightly closed.
P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P280: Wear protective gloves/protective clothing/eye protection/face protection.
P240: Ground/bond container and receiving equipment.
P241: Use explosion-proof electrical/ventilating/lighting equipment.
P243: Take precautionary measures against static discharge.
P242: Use only non-sparking tools.
P264: Wash hands thoroughly after handling.
P261: Avoid breathing gas/mist/vapours/spray.
P271: Use only outdoors or in a well-ventilated area.

GHS Response Phrases:
P370+378: In case of fire, use dry chemical to extinguish.
P303+361+353: IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337+313: If eye irritation persists, get medical advice/attention.
P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312: Call a POISON CENTER/doctor if you feel unwell.

GHS Storage and Disposal Phrases:
P403+235: Store in cool/well-ventilated place.
P501: Dispose of contents/container according to local, state and federal regulations.
P403+233: Store container tightly closed in well-ventilated place - if product is as volatile as to generate hazardous atmosphere.
P405: Store locked up.

Hazard Rating System:

HEALTH	*	2
FLAMMABILITY		3
PHYSICAL		0
PPE		x

HMIS:

NFPA:

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

Potential Health Effects (Acute and Chronic):

Inhalation Acute Exposure Effects:
Vapor harmful. May cause dizziness, headache, watering of eyes, irritation of respiratory tract, drowsiness, nausea, and numbness in fingers, arms and legs. Inhalation of high vapor concentrations can cause central nervous system depression and narcosis. May lead to unconsciousness.

Skin Contact Acute Exposure Effects:
May cause skin irritation. Liquid is absorbed readily and can transport other toxins into the body. Prolonged or repeated skin contact with liquid may cause defatting resulting in drying, redness and possible blistering.

Eye Contact Acute Exposure Effects:
This material is an eye irritant. Causes itching, burning, redness and tearing. May cause corneal injury.

Ingestion Acute Exposure Effects:
Harmful if swallowed. Aspiration hazard if swallowed - can enter lungs and cause damage. May cause irritation of the gastrointestinal tract. May cause systemic poisoning with symptoms paralleling those of inhalation.

Chronic Exposure Effects:
Reports have associated repeated and prolonged overexposure to solvents with neurological and other physiological damage. May cause weakness, fatigue, skin irritation, and numbness in hands and feet.

May cause target organ or system damage to the respiratory system, nervous system, kidney, blood system, and liver.

Target Organs:
Eyes, skin, respiratory system, central nervous system, heart

Medical Conditions Generally Aggravated By Exposure: Skin, eye, respiratory and asthma, cardiac irregularities

3. COMPOSITION/INFORMATION ON INGREDIENTS

CAS #	Hazardous Components (Chemical Name)	Concentration
67-64-1	Acetone {2-Propanone}	100.0 %

4. FIRST AID MEASURES

Emergency and First Aid Procedures:

Skin:
Immediately begin washing the skin thoroughly with large amounts of water and mild soap, if available, while removing contaminated clothing. Seek medical attention if irritation persists.

Eyes:
Immediately begin to flush eyes with water, remove any contact lens. Continue to flush the eyes for at least 15 minutes, then seek immediate medical attention.

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention.

Ingestion:
If swallowed, do NOT induce vomiting. Seek immediate medical attention. Call a physician, hospital emergency room, or poison control center immediately. Never give anything by mouth to an unconscious person.

Signs and Symptoms Of Exposure:

Primary Routes of Exposure:
Inhalation, ingestion, and dermal.

Note to Physician:

Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES

Class IB

Flash Pt: 0.00 F Method Used: TAG Closed Cup

Explosive Limits: LEL: 2.5 % at 77.0 F UEL: 13.0 % at 77.0 F

Autoignition Pt: 869.00 F

Suitable Extinguishing Media: Use carbon dioxide, dry powder, or alcohol-resistant foam.

Fire Fighting Instructions:

Self-contained respiratory protection should be provided for fire fighters fighting fires in buildings or confined areas. Storage containers exposed to fire should be kept cool with water spray to prevent pressure build-up. Stay away from heads of containers that have been exposed to intense heat or flame.

Flammable Properties and Hazards:

Extremely Flammable! Vapors are heavier than air and may spread along floors. Forms or accumulates static electricity, may cause fire or explosion.

Acetone/water solutions that contain more than 2.5% acetone have flash points. When the acetone concentration is greater than 8% by weight in a closed container, it would be within the flammable range and cause fire or explosion if a source of ignition were introduced.

Do not spread this product over a large surface area because the fire and health safety risks will increase dramatically.

6. ACCIDENTAL RELEASE MEASURES

Steps To Be Taken In Case Material Is Released Or Spilled:

Vapors may cause flash fire or ignite explosively.

Clean up: Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Shut off ignition sources; keep flares, smoking or flames out of hazard area. Use non-sparking tools. Use proper bonding and grounding methods for all equipment and processes. Keep out of waterways and bodies of water. Be cautious of vapors collecting in small enclosed spaces, sewers, low lying areas, confined spaces, etc.

Small spills: Take up with sand, earth or other noncombustible absorbent material and place in a plastic container where applicable.

Large spills: Dike far ahead of spill for later disposal.

Waste Disposal: Dispose in accordance with applicable local, state and federal regulations.

7. HANDLING AND STORAGE

Precautions To Be Taken in Handling:

Read carefully all cautions and directions on product label before use. Since empty container retains residue, follow all label warnings even after container is empty. Dispose of empty container according to all regulations. Do not reuse this container.

Do not use this product near any source of heat or open flame, furnace areas, pilot lights, stoves, etc.

Do not use in small enclosed spaces, such as basements and bathrooms. Vapors can accumulate and explode if ignited.

Do not spread this product over large surface areas because fire and health safety risks will increase dramatically.

Precautions To Be Taken in Storing:

Keep container tightly closed when not in use. Store in a cool, dry place. Do not store near any source of heat or flame, furnace areas, pilot lights, stoves, etc. Do not reuse this container. Use product within one year of purchasing.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

CAS #	Partial Chemical Name	OSHA TWA	ACGIH TWA	Other Limits
67-64-1	Acetone {2-Propanone}	PEL: 1000 ppm	TLV: 500 ppm STEL: 750 ppm	No data.

Respiratory Equipment (Specify Type):

For use in areas with inadequate ventilation or fresh air, wear a properly maintained and properly fitted NIOSH approved respirator for organic solvent vapors.

For OSHA controlled work places and other regular users - Use only with adequate ventilation under engineered air control systems designed to prevent exceeding the appropriate TLV.

A dust mask does not provide protection against vapors.

Eye Protection:

Splash goggles.

Protective Gloves: Wear gloves with as much resistance to the chemical ingredients as possible. Glove materials such as nitrile rubber, natural rubber, and neoprene may provide protection. Glove selection should be based on chemicals being used and conditions of use. Consult your glove supplier for additional information. Gloves contaminated with product should be discarded and not reused.

Other Protective Clothing: Various application methods can dictate use of additional protective safety equipment, such as impermeable aprons, etc., to minimize exposure.

Engineering Controls (Ventilation etc.): Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Use only with adequate ventilation to prevent buildup of vapors. Do not use in areas where vapors can accumulate and concentrate, such as basements, bathrooms or small enclosed areas. Whenever possible, use outdoors in an open air area. If using indoors open all windows and doors and maintain a cross ventilation of moving fresh air across the work area. If strong odor is noticed or you experience slight dizziness, headache, nausea or eye-watering -- STOP -- ventilation is inadequate. Leave area immediately and move to fresh air.

Work/Hygienic/Maintenance Practices: Wash hands thoroughly after use and before eating, drinking, smoking, or using the restroom.

Do not eat, drink, or smoke in the work area.

Discard any clothing or other protective equipment that cannot be decontaminated.

Facilities storing or handling this material should be equipped with an emergency eyewash and safety shower.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical States: [ ] Gas [X] Liquid [ ] Solid

Appearance and Odor: Clear colorless liquid with a characteristic ketone odor. Odor may be described as a sweet pungent odor.

Melting Point: No data.

Boiling Point: > 133.00 F

Autoignition Pt: 869.00 F

Flash Pt: 0.00 F Method Used: TAG Closed Cup

Explosive Limits: LEL: 2.5 % at 77.0 F UEL: 13.0 % at 77.0 F

Specific Gravity (Water = 1): 0.789

Density: 6.572 LB/GA at 77.0 F

Vapor Pressure (vs. Air or mm Hg): 213 MM HG at 77.0 F

Vapor Density (vs. Air = 1): No data.

Evaporation Rate: No data.

Solubility in Water: Complete

Percent Volatile: 100.0 % by weight.

10. STABILITY AND REACTIVITY

Stability: Unstable [ ] Stable [X]

Conditions To Avoid - Instability: No data available.

Incompatibility - Materials To Avoid: Avoid contact with acids, aldehydes, alkalies, amines, ammonia, oxidizing agents, reducing agents, chlorine compounds.

May form explosive mixtures with chromic anhydride, chromyl alcohol, hexachloromelamine, hydrogen peroxide, permonosulfuric acid, potassium tertbutoxide, and thioglycol. Strong oxidizers.

Hazardous Decomposition or Byproducts: Decomposition may produce carbon monoxide, carbon dioxide, and other asphyxiants.

Possibility of Hazardous Reactions: Will occur [ ] Will not occur [X]

Conditions To Avoid - Hazardous Reactions: No data available.

11. TOXICOLOGICAL INFORMATION

Toxicological Information: NEUROTOXICITY: Clinical studies and case reports suggest slight neurological effects, mostly of the subjective type, in individuals exposed to varying concentrations of acetone. In most studies the subjects report discomfort, irritation of the eyes and respiratory passages, mood swings, and nausea following exposure to acetone vapor at concentrations of 500 ppm or higher. The fact that the effects subside following termination of exposure indicates that acetone may be the active compound, rather than a metabolite. Case reports of accidental poisoning also indicate that the effects (e.g., lethargy and drowsiness) are short-lived.

Carcinogenicity/Other Information:

CAS# 67-64-1:
Standard Draize Test, Eyes, Species: Rabbit, 20.00 MG, Severe.
Result:
Behavioral: Change in motor activity (specific assay).
Behavioral: Alteration of classical conditioning.
- American Journal of Ophthalmology., Ophthalmic Pub. Co., 435 N. Michigan Ave., Suite 1415, Chicago, IL 60611, Vol/p/yr: 29,1363, 1946

ACGIH A4 - Not Classifiable as a Human Carcinogen.

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
67-64-1	Acetone {2-Propanone}	n.a.	n.a.	A4	n.a.

12. ECOLOGICAL INFORMATION

No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose of in accordance with all applicable local, state, and federal regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Acetone

DOT Hazard Class: 3 FLAMMABLE LIQUID
UN/NA Number: UN1090 **Packing Group:** II

Additional Transport Information: The shipper/supplier may apply one of the following exceptions: Combustible Liquid, Consumer Commodity, Limited Quantity, Viscous Liquid, Does Not Sustain Combustion, or others, as allowed under 49CFR Hazmat Regulations. Please consult 49CFR Subchapter C to ensure that subsequent shipments comply with these exceptions.

15. REGULATORY INFORMATION

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
67-64-1	Acetone {2-Propanone}	No	Yes 5000 LB	No

This material meets the EPA 'Hazard Categories' defined for SARA Title III Sections 311/312 as indicated:	[X] Yes [ ] No	Acute (immediate) Health Hazard
	[X] Yes [ ] No	Chronic (delayed) Health Hazard
	[X] Yes [ ] No	Fire Hazard
	[ ] Yes [X] No	Sudden Release of Pressure Hazard
	[ ] Yes [X] No	Reactive Hazard

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
67-64-1	Acetone {2-Propanone}	CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No

Regulatory Information: This product is regulated by the United States Consumer Product Safety Commission and is subject to certain labeling requirements under the Federal Hazardous Substances Act. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS). The product label also includes other important information, including directions for use, and should always be read in its entirety prior to using the product.

16. OTHER INFORMATION

Revision Date: 05/24/2017
Preparer Name: W.M. Barr EHS Department (901)775-0100
Additional Information About This Product: No data available.
Company Policy or Disclaimer: The information contained herein is presented in good faith and believed to be accurate as of the effective date shown above. This information is furnished without warranty of any kind. Employers should use this information only as a supplement to other information gathered by them and must make independent determination of suitability and completeness of information from all sources to assure proper use of these materials and the safety and health of employees. Any use of this data and information must be determined by the user to be in accordance with applicable federal, state and

local laws and regulations.

Safety Data Sheet

RUST-OLEUM CORPORATION
* Trusted Quality Since 1921 *
www.rustoleum.com

1. Identification

Product Name: STRUST +SSPR 6PK GLOSS BLACK

Revision Date: 5/9/2017

Product Identifier: 7779830

Supercedes Date: 9/20/2016

Product Use/Class: Topcoat/Aerosols

Supplier:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Manufacturer:
Rust-Oleum Corporation
11 Hawthorn Parkway
Vernon Hills, IL 60061
USA

Preparer: Regulatory Department

Emergency Telephone: 24 Hour Hotline: 847-367-7700

2. Hazard Identification

Classification

Symbol(s) of Product

Signal Word
Danger

Possible Hazards
34% of the mixture consists of ingredient(s) of unknown acute toxicity.

GHS HAZARD STATEMENTS

Carcinogenicity, category 1B	H350	May cause cancer.
Compressed Gas	H280	Contains gas under pressure; may explode if heated.
Eye Irritation, category 2	H319	Causes serious eye irritation.
Flammable Aerosol, category 1	H222	Extremely flammable aerosol.
Germ Cell Mutagenicity, category 1B	H340	May cause genetic defects.
STOT, repeated exposure, category 2	H373	May cause damage to organs through prolonged or repeated exposure.
STOT, single exposure, category 3, NE	H336	May cause drowsiness or dizziness.

GHS LABEL PRECAUTIONARY STATEMENTS

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P260	Do not breathe dust/fume/gas/mist/vapors/spray.
P264	Wash hands thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P337+P313	If eye irritation persists: Get medical advice/attention.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P410+P412	Protect from sunlight. Do no expose to temperatures exceeding 50°C/ 122°F.
P501	Dispose of contents/container in accordance with local, regional and national regulations.

3. Composition/Information On Ingredients

HAZARDOUS SUBSTANCES

Chemical Name	CAS-No.	Wt.% Range	GHS Symbols	GHS Statements
Acetone	67-64-1	25-50	GHS02-GHS07	H225-319-332-336
Propane	74-98-6	10-25	GHS04	H280
n-Butane	106-97-8	2.5-10	GHS04	H280
n-Butyl Acetate	123-86-4	2.5-10	GHS02-GHS07	H226-336
Barium Sulfate	7727-43-7	2.5-10	Not Available	Not Available
Xylenes (o-, m-, p- isomers)	1330-20-7	2.5-10	GHS02-GHS07	H226-315-319-332
Dimethyl Carbonate	616-38-6	2.5-10	GHS02	H225
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	2.5-10	GHS08	H304
Carbon Black	1333-86-4	1.0-2.5	Not Available	Not Available
Propylene Glycol Monobutyl Ether	5131-66-8	1.0-2.5	GHS07	H302-315-319
Ethylbenzene	100-41-4	1.0-2.5	GHS02-GHS07-GHS08	H225-304-332-351-373
Naphtha, Hydrotreated Heavy	64742-48-9	0.1-1.0	GHS08	H304-340-350

4. First-aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-fighting Measures

EXTINGUISHING MEDIA: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20°F. EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. No unusual fire or explosion hazards noted.

SPECIAL FIREFIGHTING PROCEDURES: Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only in a well-ventilated area. Use only with adequate ventilation. Follow all MSDS/label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of flammable aerosols. Keep away from heat, sparks, flame and sources of ignition. Contents under pressure. Do not expose to heat or store above 120 ° F. Avoid excess heat. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials.

8. Exposure Controls/Personal Protection

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Acetone	67-64-1	30.0	250 ppm	500 ppm	1000 ppm	N.E.
Propane	74-98-6	20.0	N.E.	N.E.	1000 ppm	N.E.
n-Butane	106-97-8	10.0	N.E.	1000 ppm	N.E.	N.E.
n-Butyl Acetate	123-86-4	10.0	50 ppm	150 ppm	150 ppm	N.E.
Barium Sulfate	7727-43-7	10.0	5 mg/m3	N.E.	15 mg/m3	N.E.
Xylenes (o-, m-, p- isomers)	1330-20-7	10.0	100 ppm	150 ppm	100 ppm	N.E.
Dimethyl Carbonate	616-38-6	5.0	N.E.	N.E.	N.E.	N.E.
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	5.0	N.E.	N.E.	N.E.	N.E.
Carbon Black	1333-86-4	5.0	3 mg/m3	N.E.	3.5 mg/m3	N.E.
Propylene Glycol Monobutyl Ether	5131-66-8	5.0	N.E.	N.E.	N.E.	N.E.
Ethylbenzene	100-41-4	5.0	20 ppm	N.E.	100 ppm	N.E.
Naphtha, Hydrotreated Heavy	64742-48-9	1.0	N.E.	N.E.	N.E.	N.E.

PERSONAL PROTECTION

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Use impervious gloves to prevent skin contact and absorption of this material through the skin. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications. Refer to safety supervisor or industrial hygienist for further information regarding personal protective equipment and its application.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

9. Physical and Chemical Properties

Appearance:	Aerosolized Mist	**Physical State:**	Liquid
Odor:	Solvent Like	**Odor Threshold:**	N.E.
Relative Density:	0.777	**pH:**	N.A.
Freeze Point, °C:	N.D.	**Viscosity:**	N.D.
Solubility in Water:	Slight	**Partition Coefficient, n-octanol/ water:**	N.D.
Decompostion Temp., °C:	N.D.		
Boiling Range, °C:	-37 - 232	**Explosive Limits, vol%:**	0.9 - 13.0
Flammability:	Supports Combustion	**Flash Point, °C:**	-96
Evaporation Rate:	Faster than Ether	**Auto-ignition Temp., °C:**	N.D.
Vapor Density:	Heavier than Air	**Vapor Pressure:**	N.D.

(See "Other information" Section for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120°F (49°C). Avoid contact with strong acid and strong bases. Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological information

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: Substance may cause slight skin irritation. May cause skin irritation. Allergic reactions are possible. Prolonged or repeated contact may cause skin irritation.

EFFECTS OF OVEREXPOSURE - INHALATION: Harmful if inhaled. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed. Aspiration hazard if swallowed; can enter lungs and cause damage.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. Contains carbon black. Chronic inflammation, lung fibrosis, and lung tumors have been observed in some rats experimentally exposed for long periods of time to excessive concentrations of carbon black and several insoluble fine dust particles. Tumors have not been observed in other animal species (i.e., mouse and hamster) under similar circumstances and study conditions. Epidemiological studies of North American workers show no evidence of clinically significant adverse health effects due to occupational exposure to carbon black.

Carbon black is listed as a Group 2B-"Possibly carcinogenic to humans" by IARC and is proposed to be listed as A4- "not classified as a human carcinogen" by the American Conference of Governmental Industrial Hygienists. Significant exposure is not anticipated during brush application or drying. Risk of overexposure depends on duration and level of exposure to dust from repeated sanding of surfaces or spray mist and the actual concentration of carbon black in the formula. IARC lists Ethylbenzene as a possible human carcinogen (group 2B).

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

ACUTE TOXICITY VALUES

The acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
67-64-1	Acetone	5800 mg/kg Rat	>15700 mg/kg Rabbit	50.1 mg/L Rat
74-98-6	Propane	N.I.	N.I.	658 mg/L Rat

106-97-8	n-Butane	N.I.	N.I.	658 mg/L Rat
123-86-4	n-Butyl Acetate	10768 mg/kg Rat	>17600 mg/kg Rabbit	> 21 mg/L Rat
1330-20-7	Xylenes (o-, m-, p- isomers)	3500 mg/kg Rat	>4350 mg/kg Rabbit	29.08 mg/L Rat
616-38-6	Dimethyl Carbonate	13000 mg/kg Rat	>5000 mg/kg Rabbit	140 mg/L Rat
64742-49-0	Naphtha, Petroleum, Hydrotreated Light	>5000 mg/kg Rat	>3160 mg/kg Rabbit	>4951 mg/L Rat
1333-86-4	Carbon Black	>15400 mg/kg Rat	N.I.	N.I.
5131-66-8	Propylene Glycol Monobutyl Ether	1900 mg/kg Rat	N.I.	N.I.
100-41-4	Ethylbenzene	3500 mg/kg Rat	15400 mg/kg Rabbit	17.4 mg/L Rat
64742-48-9	Naphtha, Hydrotreated Heavy	>5000 mg/kg Rat	>3160 mg/kg Rabbit	N.I.

N.I. - No Information

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components. Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Dispose of material in accordance to local, state, and federal regulations and ordinances. Do not allow to enter waterways, wastewater, soil, storm drains or sewer systems.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Paint Products in Limited Quantities	Aerosols	Aerosols	Paint Products in Limited Quantities
Hazard Class:	N.A.	2.1	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Fire Hazard, Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Xylenes (o-, m-, p- isomers)	1330-20-7
Dimethyl Carbonate	616-38-6
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

No TSCA 12(b) components exist in this product.

16. Other Information

HMIS RATINGS

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA RATINGS

Health:	2	**Flammability:**	4	**Instability**	0

VOLATILE ORGANIC COMPOUNDS, g/L: 530

SDS REVISION DATE: 5/9/2017

REASON FOR REVISION:
Regulatory Formula Source Changed
Product Composition Changed
Substance and/or Product Properties Changed in Section(s):
02 - Hazard Identification
09 - Physical & Chemical Properties
16 - Other Information
Statement(s) Changed

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Rust-Oleum Corporation believes, to the best of its knowledge, information and belief, the information contained herein to be accurate and reliable as of the date of this safety data sheet. However, because the conditions of handling, use, and storage of these materials are beyond our control, we assume no responsibility or liability for personal injury or property damage incurred by the use of these materials. Rust-Oleum Corporation makes no warranty, expressed or implied, regarding the accuracy or reliability of the data or results obtained from their use. All materials may present unknown hazards and should be used with caution. The information and recommendations in this material safety data sheet are offered for the users' consideration and examination. It is the responsibility of the user to determine the final suitability of this information and to comply with all applicable international, federal, state, and local laws and regulations.

MATERIAL SAFETY DATA SHEET (MSDS)

Section 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **TAP Super Hard Epoxy Hardener**
CHEMICAL FAMILY: Aliphatic Amines
MFR'S NAME: Rhino Linings, 9151 Rehco Road, San Diego, CA 92121
EMERGENCY PHONE: 800/424--9300 (Chemtrec) GENERAL INFORMATION: 858/410-6044 (Rhino)

Section 2: COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT	%	CAS #	EXPOSURE LIMITS
Reaction products w/Phenol/Formaldehyde	40-70	32610-77-8	N/E
Triethylenetetramine	15-40	112-24-3	N/E
Phenol	15-40	108-95-2	N/E

Section 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Epoxy hardener solution. Certain individuals may have pre-existing skin or respiratory conditions causing a sensitivity or allergy which manifests as various reactions. Heating or spraying this product or the mixed parts increases potential health hazards. Health and safety professionals should examine all handling procedures and remedy any health and safety hazards.

POTENTIAL HEALTH EFFECTS:

EYE:
- May cause severe irritation.

SKIN:
- May cause moderate irritation.

INGESTION:
- May inflame or damage the G.I. tract. Ingestion may be harmful.

INHALATION:
- May cause severe irritation.

CHRONIC EFFECTS:
- Repeated exposure may cause irritation or sensitization.

SIGNS & SYMPTOMS:
- Skin rash, irritation, reddening, or eczema; Breathing irritation or difficulty.

Section 4: FIRST AID MEASURES

♦USE APPROPRIATE BLOOD-BORNE PATHOGENS PROTECTIONS♦

EYE:
- Hold eyelids apart and flood with copious amounts of water. Seek medical attention.

SKIN:
- Remove excess product. Wash thoroughly with soap and water. If irritation persists, seek medical attention.

INGESTION:
- Do not induce vomiting unless directed by medical personnel. Seek medical attention.

INHALATION:
- Remove to fresh air. Seek medical attention.

Section 5: FIRE FIGHTING MEASURES

FLASH POINT: 135°C 276°F UEL: N.D.A.% LEL: N.D.A. VAPOR DENSITY: N.D.A.
NFPA FLAMMABILITY RATING: 1 AUTOIGNITION: N.D.A.
COMBUSTION PRODUCTS: CO, CO_2, NO_x, & misc. hydrocarbons
SPECIAL HAZARDS: Firefighters should wear butyl rubber boots, gloves, and body suit with SCBA. May generate toxic and irritating combustion products. Use DOT Response Guide #153.
EXTINGUISHING MEDIA: Use foam, CO_2, dry chemical, water fog.
FIRE FIGHTER INSTRUCTIONS: Stay upwind. Wear at least full bunker gear and SCBA.

Section 6: ACCIDENTAL RELEASE MEASURES

Isolate the spill area. Keep out of sewer and storm drains. Stop the leak and contain the spill. Vacuum, scoop, or absorb spilled with non-combustible materials. Clean spill residues with soap and water.

Section 7: HANDLING AND STORAGE

Avoid skin and eye contact and breathing vapors by appropriate measures. Do not eat or smoke while handling this product. Wash thoroughly with soap and water after handling or exposure to this product.

Store in original sealed container at ambient temperatures (65°-80°F) in dry, well-ventilated areas.

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

For Personal exposure Limits (PEL), Threshold Limit Values (TLV), or other exposure limits, see Sec.2.
GENERAL: Provide adequate ventilation that will keep airborne concentration at a minimum.
EYE/FACE: Safety glasses or splash goggles with face shield.
SKIN: Butyl or nitrile rubber chemical gloves. Don chemical resistant clothing where exposure may occur.
RESPIRATORY: NIOSH approved respirator with organic vapor/HEPA filter cartridges.
OTHER: Decontaminate or discard clothing and materials that have come in contact with this product.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: amber liquid	ODOR: phenol	PHYSICAL STATE: liquid
VAPOR PRESS: <1 mm/Hg	SPECIFIC GRAVITY: 1.08	pH: alkaline
BOILING PT: N.D.A.	MELT PT: N/A	SOLUBILITY IN H_2O: moderate

Section 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.
INCOMPATIBILITY: Strong oxidizers, acids, epoxy resins in uncontrolled conditions; contact with other unpolymerized monomers or polymers.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: None known, other than Sec. 5's Combustion Products.

Section 11: TOXICOLOGICAL INFORMATION

Oral: N.D.A.
Dermal: N.D.A.
Inhalation: N.D.A.
Carcinogens under OSHA, ACGIH, NTP, IARC, or Other: None ≥ 0.1%.

Section 12: ECOLOGICAL INFORMATION

N.D.A.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with applicable federal, state, and local laws and regulations.

Section 14: TRANSPORT INFORMATION

DOT: Not Regulated.
IATA:
IMO:

Section 15: REGULATORY INFORMATION

OSHA: 1910.1200 Hazardous Chemical “Irritant”, “Sensitizer”.
TSCA: Contains listed ingredients.
SARA III: Sec311 & 312 Immediate Health Hazard; Sec313 Chemical above de minimus level: Phenol.
CA PROP. 65 NOTICE: Not listed.
NFPA: HEALTH 2 FIRE 1 REACTIVITY 0 OTHER N/A

Section 16: CANADIAN REGULATORY INFORMATION

WHMIS: Hazard Classification: Class D Division 2A, Class D Division 2B.
WHMIS Symbols: Stylized T.
Trade Secrets: N/A.
Hazardous Products Act Information: This product MSDS contains ingredients which are Controlled and/or on the Ingredient Disclosure List (HPA sections 13 and 14).

ABBREVIATIONS: N/A = not applicable; N.D.A. = no data available; NE = not established

END OF MSDS

MATERIAL SAFETY DATA SHEET (MSDS)

Section 1: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **TAP Super Hard Epoxy Resin**
Chemical Family: Epoxy Resin Mixture
MFR'S NAME: Rhino Linings, 9151 Rehco Road, San Diego, CA 92121
EMERGENCY PHONE: 800/424--9300 (Chemtrec) GENERAL INFORMATION: 858/410-6044 (Rhino)

Section 2: COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT	%	CAS #	EXPOSURE LIMITS
Bisphenol A Reaction Product	<80	25085-99-8	N/E
Aliphatic Glycidyl Ether	>10	68609-97-2	N/E
Proprietary ingredients	>10	Trade secret	N/E

Section 3: HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Epoxy resin solution. Certain individuals may have pre-existing skin or respiratory conditions causing a sensitivity or allergy which manifests as various reactions. Heating or spraying this product or the mixed parts increases potential health hazards. Health and Safety personnel should examine the handling procedures and remedy any existing or potential health and safety hazards.

POTENTIAL HEALTH EFFECTS:

EYE:
- May cause irritation.

SKIN:
- May cause irritation. Low dermal absorption hazard.

INGESTION:
- May inflame or damage the G.I. tract. Ingestion may be harmful.

INHALATION:
- May cause irritation.

CHRONIC EFFECTS:
- Repeated exposure may cause irritation and sensitization.

SIGNS & SYMPTOMS:
- Skin rash, irritation, reddening, or eczema; breathing irritation or difficulty.

Section 4: FIRST AID MEASURES

♦USE APPROPRIATE BLOOD-BORNE PATHOGENS PROTECTIONS♦

EYE:
- Hold eyelids apart and flood with copious amounts of water. Seek medical attention.

SKIN:
- Remove excess product. Wash thoroughly with soap and water. If irritation persists, seek medical attention.

INGESTION:
- Do not induce vomiting unless directed by medical personnel. Seek medical attention.

INHALATION:
- Remove to fresh air. Seek medical attention.

Section 5: FIRE FIGHTING MEASURES

FLASH POINT: 177°C 350°F UEL: N/A LEL: N/A VAPOR DENSITY: N/A
NFPA FLAMMABILITY RATING: 1 AUTOIGNITION: 300°C 570°F
COMBUSTION PRODUCTS: CO, CO_2, NO_x, & misc. hydrocarbons.
SPECIAL HAZARDS: Pre-sensitization to epoxy.
EXTINGUISHING MEDIA: Use foam, CO_2, dry chemical, water fog.
FIRE FIGHTER INSTRUCTIONS: Stay upwind. Wear at least full bunker gear and SCBA.

Section 6: ACCIDENTAL RELEASE MEASURES

Isolate spill area. Keep out of sewer and storm drains. Stop the leak and contain the spill. Vacuum, scoop, or absorb spill with non-combustible materials. Clean up spill residues with soap and water.

Section 7: HANDLING AND STORAGE

Avoid skin and eye contact and breathing vapors or mists by appropriate measures. Do not eat or smoke while handling this product. Wash thoroughly after handling or exposure to this product.

Store in original sealed container at ambient temperatures (65°-80°F) in dry, well-ventilated areas.

Section 8: EXPOSURE CONTROLS, PERSONAL PROTECTION

For Personal Exposure Limits (PEL), Threshold Limit Values (TLV) or other exposure limits, see Sec. 2.
GENERAL: Provide ventilation that will keep airborne concentration at a minimum.
EYE/FACE: Safety glasses or splash goggles with face shield.
SKIN: Butyl or nitrile rubber chemical gloves. Don chemical resistant clothing where exposure may occur.
RESPIRATORY: NIOSH approved respirator with organic vapor/HEPA filter cartridges.
OTHER: Decontaminate or discard clothing and materials that have come in contact with this product.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE: clear syrup ODOR: slightly sweet PHYSICAL STATE: liquid
VAPOR PRESS: N.D.A. SPECIFIC GRAVITY: 1.10 pH: N.D.A.
BOILING PT: N.D.A. MELT PT: N/A SOLUBILITY IN H_2O: slightly

Section 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.
INCOMPATIBILITY: Strong acids, caustics, oxidizers, and epoxy hardeners in an uncontrolled condition.
HAZARDOUS POLYMERIZATION: Will not occur.
HAZARDOUS DECOMPOSITION: None known, other than Sec. 5's Combustion Products.

Section 11: TOXICOLOGICAL INFORMATION

Oral: N.D.A.
Dermal: N.D.A.
Inhalation: N.D.A.
Carcinogens under OSHA, ACGIH, NTP, IARC, or Other: None ≥ 0.1%.

Section 12: ECOLOGICAL INFORMATION

N.D.A.

Section 13: DISPOSAL CONSIDERATIONS

Dispose of in accordance with applicable federal, state, and local laws and regulations.

Section 14: TRANSPORT INFORMATION

DOT: Not Regulated.
IATA:
IMO:

Section 15: REGULATORY INFORMATION

OSHA: 29 CFR 1910.1200 Hazardous Chemical “Irritant”, “Sensitizer”.
TSCA: Ingredients listed.
SARA III: Sec311 & 312 Immediate Health Hazard; Sec313 Not listed.
CA PROP. 65 NOTICE: Not listed.
NFPA: Health 1 Fire 1 Reactivity 0 Other N/A

Section 16: CANADIAN REGULATORY INFORMATION

WHMIS: Hazard Classification: Class D2B Skin Sensitizer. Refer to MSDS for specific warnings.
WHMIS Symbols: Stylized T.
WHMIS Trade Secret Registry Numbers: None.
Hazardous Products Act Information: This product MSDS contains ingredients which are Controlled and/or on the Ingredient Disclosure List (HPA sections 13 and 14).

ABBREVIATIONS: N/A = not applicable; N.D.A. = no data available; NE = not established

END OF MSDS

Safety Data Sheet

1 - Identification

Product Name: WD-40 Multi-Use Product Aerosol *NOT FOR SALE IN CALIFORNIA* **Product Use: Lubricant, Penetrant, Drives Out Moisture, Removes and Protects Surfaces From Corrosion** **Restrictions on Use: None identified** **SDS Date Of Preparation: 07/20/2014**	**Manufacturer: WD-40 Company** **Address: 1061 Cudahy Place (92110)** **P.O. Box 80607** **San Diego, California, USA** **92138 –0607** **Telephone:** **Emergency only: 1-888-324-7596 (PROSAR)** **Information: 1-888-324-7596** **Chemical Spills: 1-800-424-9300 (Chemtrec)** **1-703-527-3887 (International Calls)**

2 – Hazards Identification

Hazcom 2012/GHS Classification:
Flammable Aerosol Category 1
Gas Under Pressure: Compressed Gas
Aspiration Toxicity Category 1

Note: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label Elements:

DANGER!
Extremely Flammable Aerosol.
Contains gas under pressure; may explode if heated.
May be fatal if swallowed and enters airways.

Prevention
Keep away from heat, sparks, open flames, hot surfaces – No smoking.
Do not spray on an open flame or other ignition source.
Pressurized container: Do not pierce or burn, even after use.

Response
IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting.

Storage
Store locked up.
Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Store in a well-ventilated place.

Disposal
Dispose of contents and container in accordance with local and national regulations.

3 - Composition/Information on Ingredients

Ingredient	CAS #	Weight Percent	US Hazcom 2012/ GHS Classification
Aliphatic Hydrocarbon	64742-47-8	45-50	Flammable Liquid Category 3

			Aspiration Toxicity Category 1
Petroleum Base Oil	64742-56-9 64742-65-0 64742-53-6 64742-54-7 64742-71-8	<25	Not Hazardous
LVP Aliphatic Hydrocarbon	64742-47-8	12-18	Aspiration Toxicity Category 1
Carbon Dioxide	124-38-9	2-3	Simple Asphyxiant Gas Under Pressure, Compressed Gas
Non-Hazardous Ingredients	Mixture	<10	Not Hazardous

Note: The exact percentages are a trade secret.

4 – First Aid Measures

Ingestion (Swallowed): Aspiration Hazard. DO NOT induce vomiting. Call physician, poison control center or the WD-40 Safety Hotline at 1-888-324-7596 immediately.
Eye Contact: Flush thoroughly with water. Remove contact lenses if present after the first 5 minutes and continue flushing for several more minutes. Get medical attention if irritation persists.
Skin Contact: Wash with soap and water. If irritation develops and persists, get medical attention.
Inhalation (Breathing): If irritation is experienced, move to fresh air. Get medical attention if irritation or other symptoms develop and persist.
Signs and Symptoms of Exposure: May cause eye and respiratory irritation. Inhalation may cause coughing, headache and dizziness. Skin contact may cause drying of the skin.
Indication of Immediate Medical Attention/Special Treatment Needed: Immediate medical attention is needed for ingestion.

5 – Fire Fighting Measures

Suitable (and unsuitable) Extinguishing Media: Use water fog, dry chemical, carbon dioxide or foam. Do not use water jet or flooding amounts of water. Burning product will float on the surface and spread fire.
Specific Hazards Arising from the Chemical: Contents under pressure. Keep away from ignition sources and open flames. Exposure of containers to extreme heat and flames can cause them to rupture often with violent force. Vapors are heavier than air and may travel along surfaces to remote ignition sources and flash back. Combustion will produce oxides of carbon and hydrocarbons.
Special Protective Equipment and Precautions for Fire-Fighters: Firefighters should always wear positive pressure self-contained breathing apparatus and full protective clothing. Cool fire-exposed containers with water. Use shielding to protect against bursting containers.

6 – Accidental Release Measures

Personal Precautions, Protective Equipment and Emergency Procedures: Wear appropriate protective clothing (see Section 8). Eliminate all sources of ignition and ventilate area.
Methods and Materials for Containment/Cleanup: Leaking cans should be placed in a plastic bag or open pail until the pressure has dissipated. Contain and collect liquid with an inert absorbent and place in a container for disposal. Clean spill area thoroughly. Report spills to authorities as required.

7 – Handling and Storage

Precautions for Safe Handling: Avoid contact with eyes. Avoid prolonged contact with skin. Avoid breathing vapors or aerosols. Use only with adequate ventilation. Keep away from heat, sparks, pilot lights, hot surfaces and open flames. Unplug electrical tools, motors and appliances before spraying or bringing the can near any source of electricity. Electricity can burn a hole in the can and cause contents to burst into flames. To avoid serious burn injury, do not let the can touch battery terminals, electrical connections on motors or appliances or any other source of electricity. Wash thoroughly with soap and water after handling. Keep containers closed when not in use. Keep out of the reach of children. Do not puncture, crush or incinerate containers, even when empty.

Conditions for Safe Storage: Store in a cool, well-ventilated area, away from incompatible materials Do not store above 120°F or in direct sunlight. U.F.C (NFPA 30B) Level 3 Aerosol. Store away from oxidizers.

8 – Exposure Controls/Personal Protection

Chemical	Occupational Exposure Limits
Aliphatic Hydrocarbon	1200 mg/m3 TWA (manufacturer recommended)
Petroleum Base Oil	5 mg/m3 TWA, 10 mg/m3 STEL ACGIH TLV 5 mg/m3 TWA OSHA PEL
LVP Aliphatic Hydrocarbon	1200 mg/m3 TWA (manufacturer recommended)
Carbon Dioxide	5000 ppm TWA (OSHA/ACGIH), 30,000 ppm STEL (ACGIH)
Non-Hazardous Ingredients	None Established

The Following Controls are Recommended for Normal Consumer Use of this Product
Appropriate Engineering Controls: Use in a well-ventilated area.
Personal Protection:
Eye Protection: Avoid eye contact. Always spray away from your face.
Skin Protection: Avoid prolonged skin contact. Chemical resistant gloves recommended for operations where skin contact is likely.
Respiratory Protection: None needed for normal use with adequate ventilation.

For Bulk Processing or Workplace Use the Following Controls are Recommended
Appropriate Engineering Controls: Use adequate general and local exhaust ventilation to maintain exposure levels below that occupational exposure limits.
Personal Protection:
Eye Protection: Safety goggles recommended where eye contact is possible.
Skin Protection: Wear chemical resistant gloves.
Respiratory Protection: None required if ventilation is adequate. If the occupational exposure limits are exceeded, wear a NIOSH approved respirator. Respirator selection and use should be based on contaminant type, form and concentration. Follow OSHA 1910.134, ANSI Z88.2 and good Industrial Hygiene practice.
Work/Hygiene Practices: Wash with soap and water after handling.

9 – Physical and Chemical Properties

Appearance:	Light amber liquid	Flammable Limits: (Solvent Portion)	LEL: 0.6% UEL: 8%
Odor:	Mild petroleum odor	Vapor Pressure:	95-115 PSI @ 70°F
Odor Threshold:	Not established	Vapor Density:	Greater than 1 (air=1)
pH:	Not Applicable	Relative Density:	0.8 – 0.82 @ 60°F
Melting/Freezing Point	Not established	Solubilities:	Insoluble in water
Boiling Point/Range:	361 - 369°F (183 - 187°C)	Partition Coefficient; n-octanol/water:	Not established
Flash Point:	122°F (49°C) Tag Closed Cup (concentrate)	Autoignition Temperature:	Not established
Evaporation Rate:	Not established	Decomposition Temperature:	Not established
Flammability (solid, gas)	Flammable Aerosol	Viscosity:	2.79-2.96 cSt @ 100°F
VOC:	412 grams/liter (49.5%)	Pour Point:	-63°C (-81.4°F) ASTM D-97

10 – Stability and Reactivity

Reactivity: Not reactive under normal conditions
Chemical Stability: Stable

Possibility of Hazardous Reactions: May react with strong oxidizers generating heat.
Conditions to Avoid: Avoid heat, sparks, flames and other sources of ignition. Do not puncture or incinerate containers.
Incompatible Materials: Strong oxidizing agents.
Hazardous Decomposition Products: Carbon monoxide and carbon dioxide.

11 – Toxicological Information

Symptoms of Overexposure:
Inhalation: High concentrations may cause nasal and respiratory irritation and central nervous system effects such as headache, dizziness and nausea. Intentional abuse may be harmful or fatal.
Skin Contact: Prolonged and/or repeated contact may produce mild irritation and defatting with possible dermatitis.
Eye Contact: Contact may be irritating to eyes. May cause redness and tearing.
Ingestion: This product has low oral toxicity. Swallowing may cause gastrointestinal irritation, nausea, vomiting and diarrhea. This product is an aspiration hazard. If swallowed, can enter the lungs and may cause chemical pneumonitis, severe lung damage and death.
Chronic Effects: None expected.
Carcinogen Status: None of the components are listed as a carcinogen or suspect carcinogen by IARC, NTP, ACGIH or OSHA.
Reproductive Toxicity: None of the components is considered a reproductive hazard.

Numerical Measures of Toxicity:
The oral toxicity of this product is estimated to be greater than 5,000 mg/kg and the dermal toxicity greater than 2,000 mg/kg based on an assessment of the ingredients. This product is not classified as toxic by established criteria. It is an aspiration hazard.

12 – Ecological Information

Ecotoxicity: No specific aquatic toxicity data is currently available, however components of this product are not expected to be harmful to aquatic organisms
Persistence and Degradability: Component are readily biodegradable.
Bioaccumulative Potential: Bioaccumulation is not expected based on an assessment of the ingredients.
Mobility in Soil: No data available
Other Adverse Effects: None known

13 - Disposal Considerations

If this product becomes a waste, it would be expected to meet the criteria of a RCRA ignitable hazardous waste (D001). However, it is the responsibility of the generator to determine at the time of disposal the proper classification and method of disposal. Do not puncture or incinerate containers, even empty. Dispose in accordance with federal, state, and local regulations.

14 – Transportation Information_

DOT Surface Shipping Description:
UN1950, Aerosols, 2.1 Ltd. Qty (Note: Shipping Papers are not required for Limited Quantities unless transported by air or vessel – each package must be marked with the Limited Quantity Mark)
IMDG Shipping Description: Un1950, Aerosols, 2.1, LTD QTY
ICAO Shipping Description: UN1950, Aerosols, flammable, 2.1 NOTE: WD-40 does not test aerosol cans to assure that they meet the pressure and other requirements for transport by air. We do not recommend that our aerosol products be transported by air.

15 – Regulatory Information

U.S. Federal Regulations:
CERCLA 103 Reportable Quantity: This product is not subject to CERCLA reporting requirements, however, oil spills are reportable to the National Response Center under the Clean Water Act and many

states have more stringent release reporting requirements. Report spills required under federal, state and local regulations.
SARA TITLE III:
Hazard Category For Section 311/312: Acute Health, Fire Hazard, Sudden Release of Pressure
Section 313 Toxic Chemicals: This product contains the following chemicals subject to SARA Title III Section 313 Reporting requirements: None
Section 302 Extremely Hazardous Substances (TPQ): None
EPA Toxic Substances Control Act (TSCA) Status: All of the components of this product are listed on the TSCA inventory.
VOC Regulations: This product complies with the consumer product VOC limits of the US EPA and states adopting the OTC VOC rules but does not comply with CARB.
California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): This product does not contain chemicals regulated under California Proposition 65.
Canadian Environmental Protection Act: One of the components is listed on the NDSL. All of the other ingredients are listed on the Canadian Domestic Substances List or exempt from notification.
Canadian WHMIS Classification: Class A (Compressed gas), Class B-5 (Flammable Aerosol)
This MSDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the MSDS contains all of the information required by the CPR.

16 – Other Information:

HMIS Hazard Rating:
Health – 1 (slight hazard), Fire Hazard – 4 (severe hazard), Reactivity – 0 (minimal hazard)

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Revision Summary: Convert to Hazcom 2012. Changes in all sections.

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