AKRONAUTS

Rocket Design Team

Project LAZARUS

Flight Readiness Addendum

The University of Akron
College of Engineering
302 E Buchtel Ave
Akron, OH 44325

NASA Student Launch Initiative

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I. Summary of Successful Launch

Due to the failed launch hosted on March 3rd, the launch vehicle was quickly reconstructed utilizing commercial body tubes and a relaunch was performed on March 22nd in Amherst, Ohio with much success. The launch vehicle reached an apogee of 5,045 ft and a top velocity of 591 ft/s. The airbrakes, drogue, and main all deployed as expected and caused no issues with the stability of the rocket. The drogue parachute descended the rocket by 87 ft/s. The main parachute's shroud lines were mildly tangled and caused the vehicle to come down at a velocity of 51 ft/s.

Failure Minor Adjustments Needed Successful

Event	March 3rd Primary Launch Conclusion	March 22nd Re-Launch Conclusion
Launch Rail Exit Velocity	22ft/s	66 ft/s
Airbrake Deployment Altitude	Before motor burnout	>4,000 ft
Apogee	960 ft	5045 ft
Drogue Ejection	Failed	Success
Main Ejection (Jolly Logic)	Success (Assess drogue ejection)	Success
Descent	Ballistic	51 ft/s (Assess packing method)
GPS Tracking	Success	Success
FINAL LAUNCH ASSESSMENT	**FAILURE**	**SUCCESS**

II. Actions Taken to Ensure Success

During the Akronauts' FRR presentation, the NASA SLI RSO provided expert and useful advice that if the issue of the initial flight was in fact due to a faulty motor, to review the flight data to see the burntime of the fuel. If the burntime was drastically different from the burntime suggested in the manufacturer's specification sheet, then it could be concluded that the wrong nozzle was shipped. Unfortunately, no data was collected from the flight, because the black powder charges damaged the altimeters. The team alternatively reviewed video footage of the launch and still had inconclusive results. Therefore, the team addressed any and all issues as best as possible in the table outlined below to ensure a successful re-launch.

Event	March 3rd Primary Launch Conclusion	Action Taken Before Re-Flight
Launch Rail Exit Velocity	22ft/s	Use NASA size rail of 10ft rather than 8ft
Airbrake Deployment Altitude	Before motor burnout	Optimize fastenings on airbrakes
Apogee	960 ft	Use competition motor for accurate apogee
Drogue Ejection	Failed	Ensure pressure vessel is sealed
Main Ejection (Jolly Logic)	Success (Assess drogue ejection)	Ensure pre-launch packing checklist is followed
Descent	Ballistic	Ejection test prior to launch
GPS Tracking	Success	No action required

III. Launch Day Observations

The re-constructed rocket has a stability margin of 2.5. The OpenRocket projected altitude was 5,040 feet while the RASAero prediction was 5,077 feet. The actual altitude achieved by the launch vehicle was 5,045. Both OpenRocket and RASAero proved to be accurate simulations of the as-built launch vehicle. By removing some stability ballast weight based on launch day conditions for the competition flight, the team is confident that the launch vehicle can reach very close to the goal apogee of 5,280 feet.

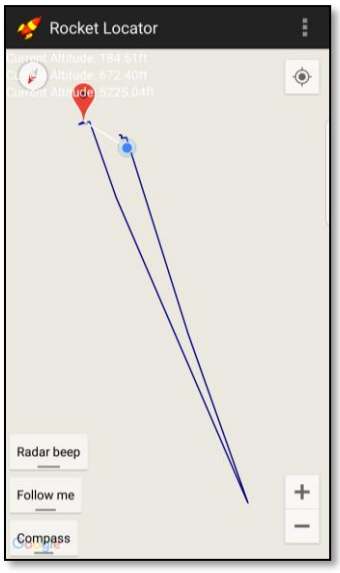
Before the test launch, ground tests were conducted and determined that 4g of black powder is to be used for the primary ejection and 5g is to be used for the redundant ejection. At apogee, which was 5045 feet, the primary ejection charge went off and after a two second delay the redundant charge went off. At apogee the drogue parachute was deployed. At an altitude of 500 feet, the primary and redundant Jolly Logic Chute Release released the main parachute.

During inflation, it became apparent that the shroud lines were tangled as seen on the next page, thus the parachute did not fully inflate. It has been determined that this issue is due to the fact that the method of parachute packing differed than in the past, not due to shroud line length or quantity. In the past, the team has launched parachutes with more shroud lines without any tangling occurring during inflation. The parachutes in the past were packed by wrapping the shroud lines around the parachute. For this launch, the shroud lines were folded beside the main parachute and had the Jolly Logic Chute Release wrapped around the lines and the parachute. This was done since the Jolly Logic Chute Release is supposed to have the shroud lines folded next to the parachute, instead of wrapped around.

For the payload ballast, 1.93lbs was used through flight and recovery. In addition to the ballast, the payload bay contained the spring ejection systems that will be used in the competition launch. Assembling the rocket before the launch as well as the test launch itself demonstrated that the spring ejection systems were fully compressed within the airframe. This indicated that oscillations in the springs would be non-existent, and therefore are not a concern for flight.

IV. Flight Data

The process of recovering the flight data was flawless. An android mobile phone application called "Rocket Locator," helped integrate with the GPS/RTx system. In doing such, a map gave the recovery team visualization of where the rocket landed using their smartphone as seen below.



The data retrieved from the altimeters provided Z coordinates while the data retrieved from the GPS provided X and Y coordinates throughout the launch. These three combined allowed the team to overlay the data into Google Earth to depict the flight path of the rocket during the relaunch. This overlay can be seen on the next page.

From the altimeters, changes in altitude and velocity were measured to gather measurements on the maximum altitude reached throughout the flight. Both altimeters sent a successful ignition charge to the recovery bay to deploy the drogue parachute at apogee. When post processing data, it appeared as the redundant altimeter did not pick up on the accurate changes in velocity. However, it did read the correct settings for altitude, and pressure. The electronics team is not concerned with the incorrect readings on the second altimeter, due to the drogue charge being initiated by the altitude changes. The electronics team will be running diagnostics on the altimeters and reprogramming the settings in hopes of fixing the issue. The maximum altitude reached 5,045 feet. Please see below picture of altimeter data.