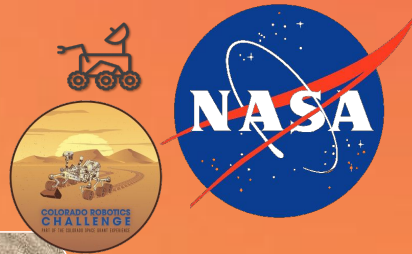


# Dune Crawler

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**Red Rocks Community College Sand Foxes - 2025-2026**



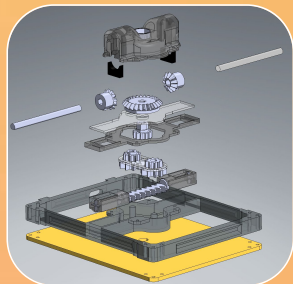
## Abstract

Our goal was to create a super awesome robot able to navigate completely autonomously on varying and rough terrain, such as soft sand, rough rocks, and snow. This was attempted with an OAK-D lite 3D camera, a Raspberry Pi 5, an internal differential, and dreadnought wheels.

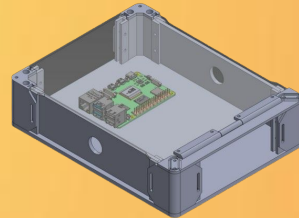


## Final Design

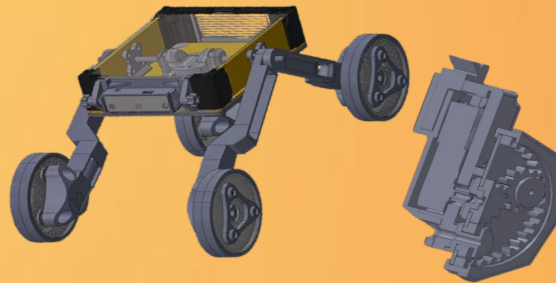
- Mechanical
  - Unique Dreadnought Wheels with custom 4 to 1 planetary gearbox and 40 rpm right angle gearmotors (that lacked in quality\*)
  - Rocker design with differential
- Electrical
  - Raspberry Pi 5 with OAK-D lite 4 encoders and BNO - 085 IMU
  - 10 AMP Motor Controllers with 4s 3.3 Ah lipo battery
- Python Code
  - Dynamically turns to avoid obstacles at various distances
  - Recognises when a motor is slow or stalled.
  - Utilizes the imu to set direction



## Design Iterations



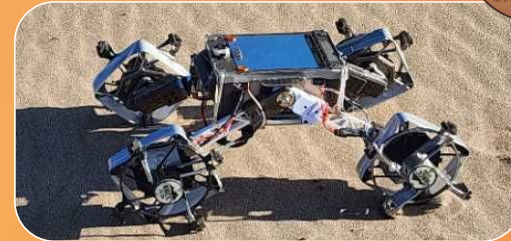
**v0** - Shows that we began from a box as all engineers do.



**v0.5** - Shows the first iteration of the planetary gearbox and differential concepts before it had the shown octagonal wheel connector.



**v1** - First terrain movement test, this turned out to be extremely promising. It was tested with new gearboxes and motors\* so no degradation had occurred yet. Scan the QR code to see videos!



← **FINAL** version photo shows 2nd test on comp day with tape added for sand buoyancy after initially noticing torque loss.

## Conclusion

The Dune Crawler may not have won the best rover award but it won a spot in our hearts.

The Dune Crawlers weaknesses surfaced on competition day. As the grains of sand found their way into the planetary gearbox, the friction within our wheels increased. This slowly eroded away our motors strength and caused them to fail.

The sealing method, as well as our testing, did not properly account for the full impact that fine sand has. The beautiful sand present at the Great Sand Dunes that has been weathered down through time was the greatest obstacle we faced.

These results led to a unanimous decision for future RRCC robotics teams to purchase stronger motors and drastically improve sealing methods and testing.

The Dune Crawler represented an ambitious vision for our team, and though we encountered limitations along the way, we recognize that progress extends beyond technical outcomes. We are proud to present a project that reflects our dedication, resilience, and the significant strides we have made as a team.

## Competition Requirements

- <1.5kg, or between 1.5kg and 5kg (ours was 5 kg)
- About the size of a cat
- Total cost must be less than \$500 (ours was \$489)
- No GPS Navigation

Want to see all our photos? scan below!

