Lunar ROADSTER

(Robotic Operator for Autonomous Development of Surface Trails and Exploration Routes)

"Starting with a foothold on the Moon, we pave the way to the cosmos"

Software: External Infrastructure (T05)

TX2 Chip and LAN Router

Connecting with Total Station

Software: Localization Stack (T09)

Global Localization (**Done**)

- Leica TS16: Provides precise x, y, z coordinates using a total station
- Used for absolute positioning in a known reference frame

Local Localization (**Done**)

- VectorNav IMU: Measures acceleration and angular velocity for state estimation
- Wheel Encoders: Tracks wheel rotations for relative movement estimation
- Helps in odometry-based localization (path taken is continuous)

Sensor Fusion with Extended Kalman Filter (EKF)

- Uses **robot_localization** package in ROS2

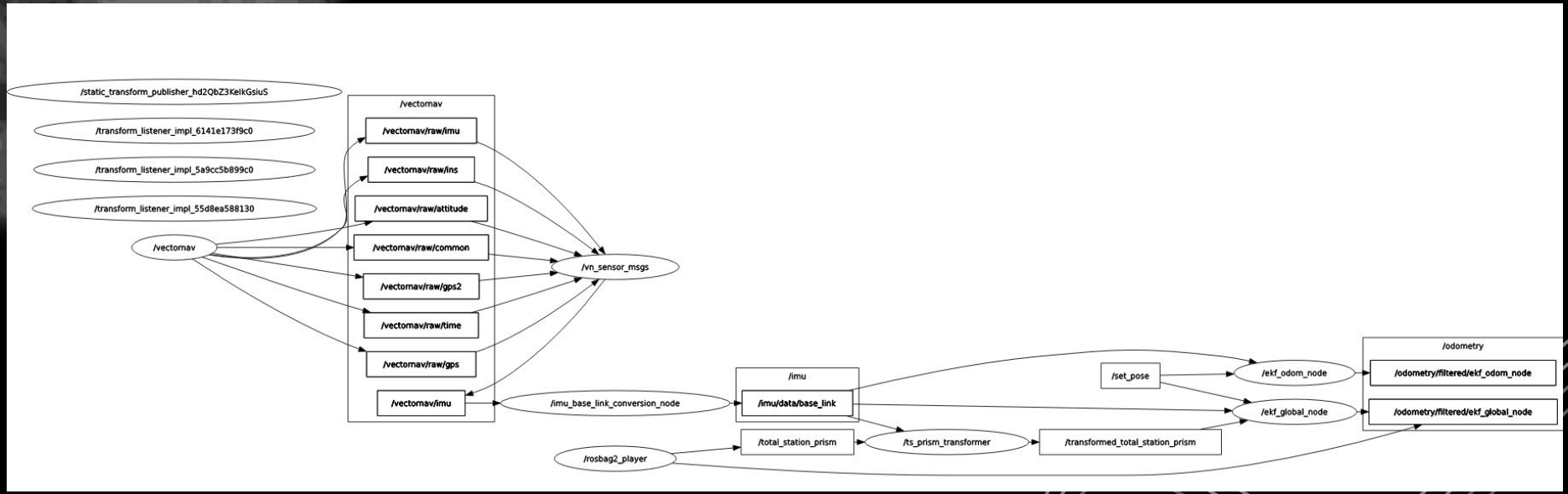
Wheel Slip Estimation

- Uses difference between pose given by global localization and local localization to track slippage

Next step – Test the entire localization stack

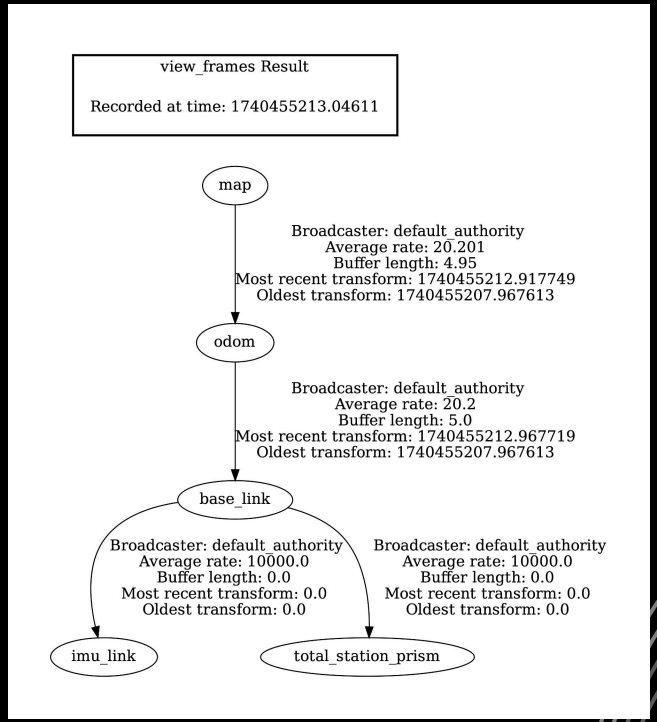
Software: Localization Stack (T09)

RQT Graph



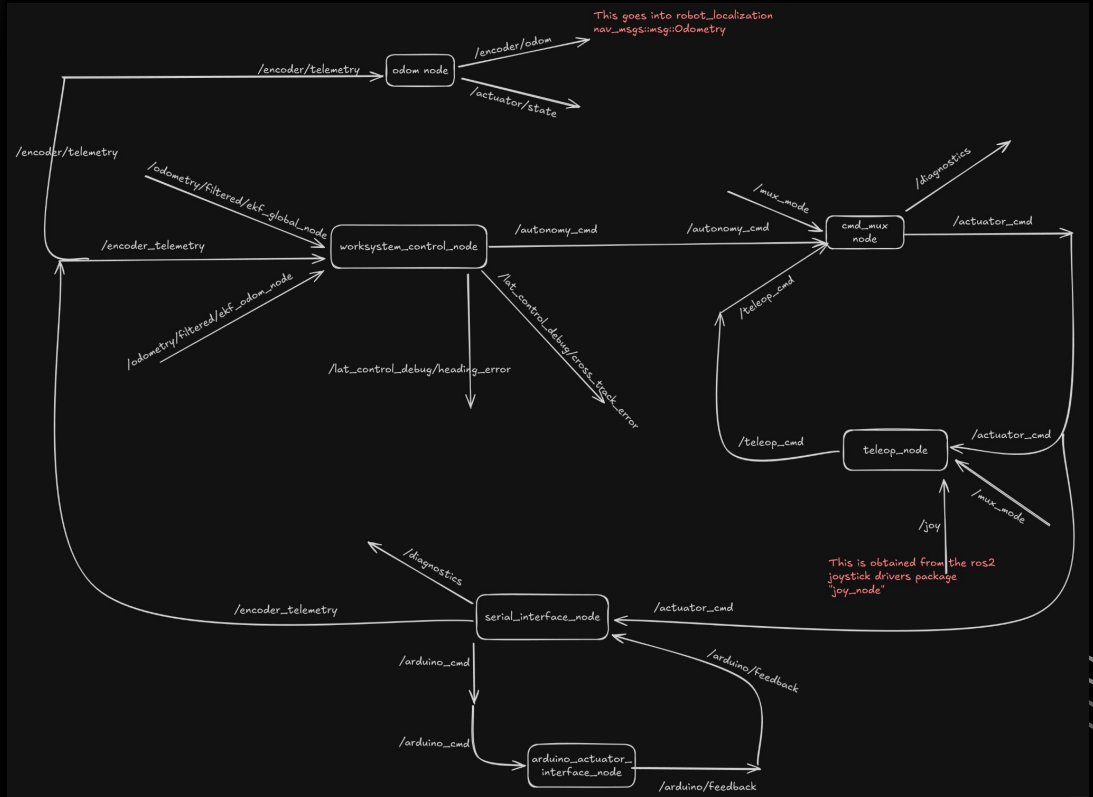
Software: Localization Stack (T09)

TF Tree

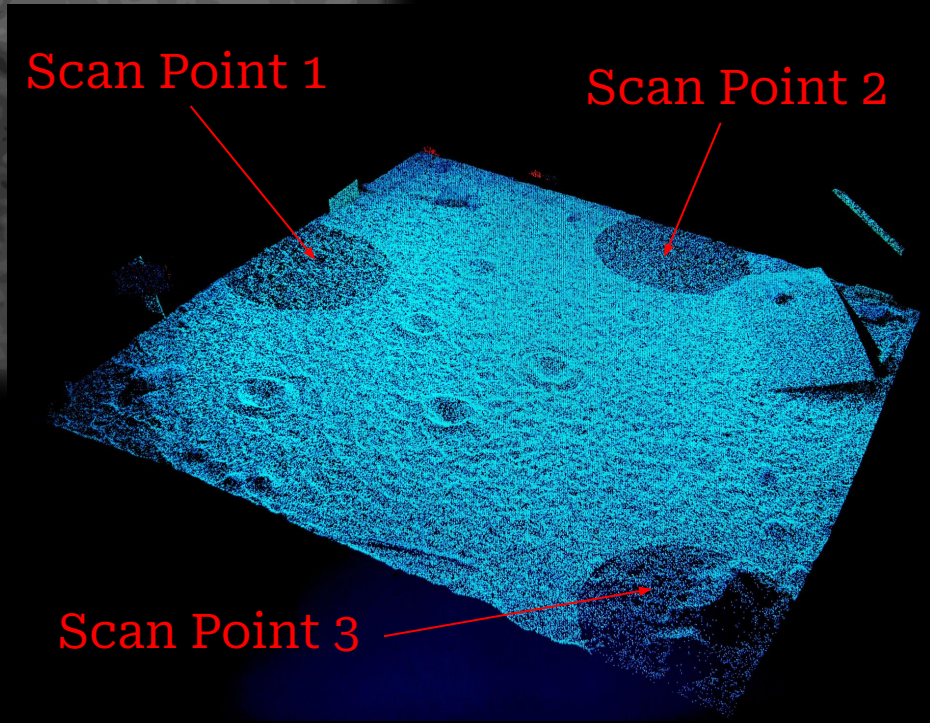


Software: Motion Control Stack (T11)

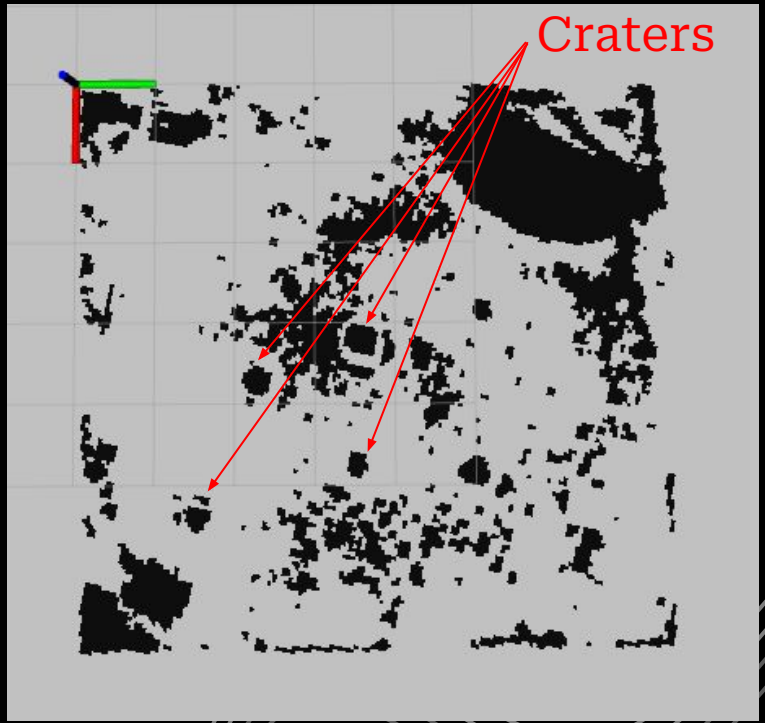
Interfacing Teleop nodes, serial interface nodes, and odometry node to connect to the localization stack – Also forms the basis for the navigation stack



Software: Moon Yard Mapping, Occupancy Grid (T08)

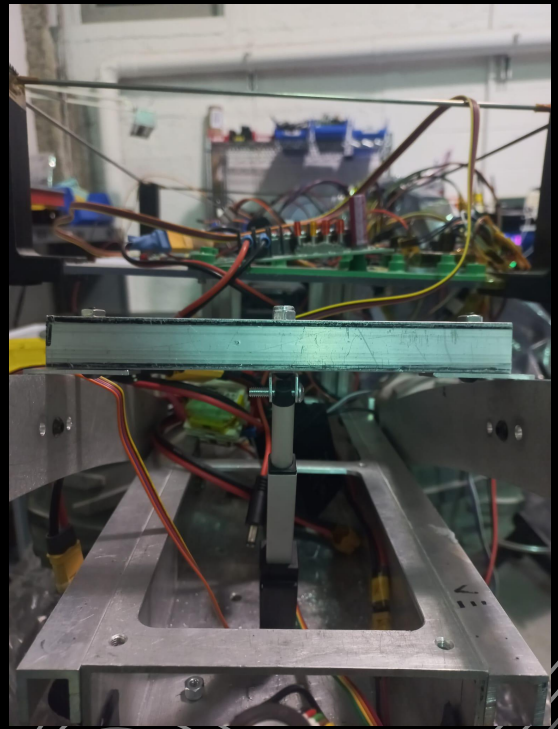


Point Cloud Visualization



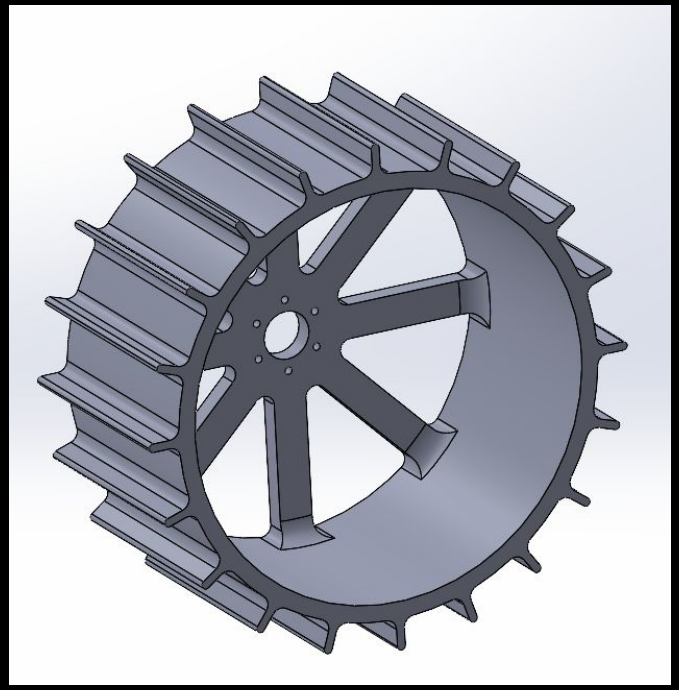
Occupancy Grid Map

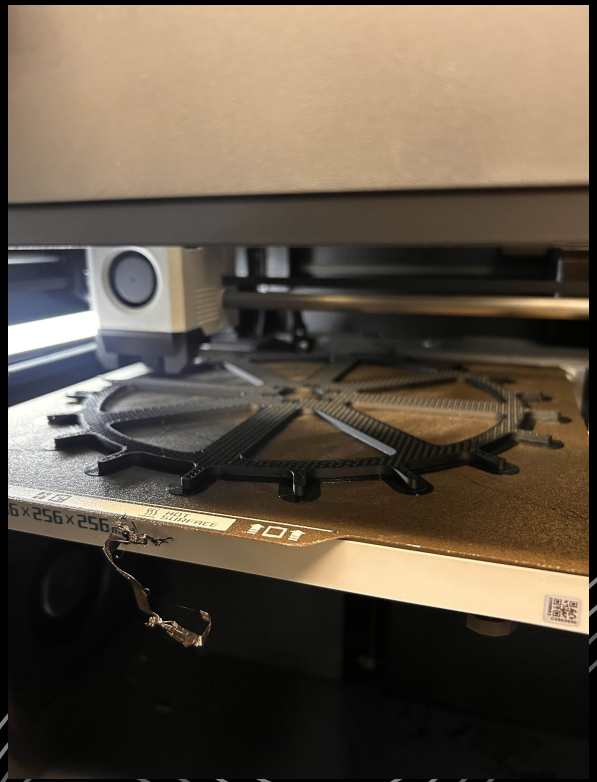
Hardware: Dozer Blade Assembly (T04)



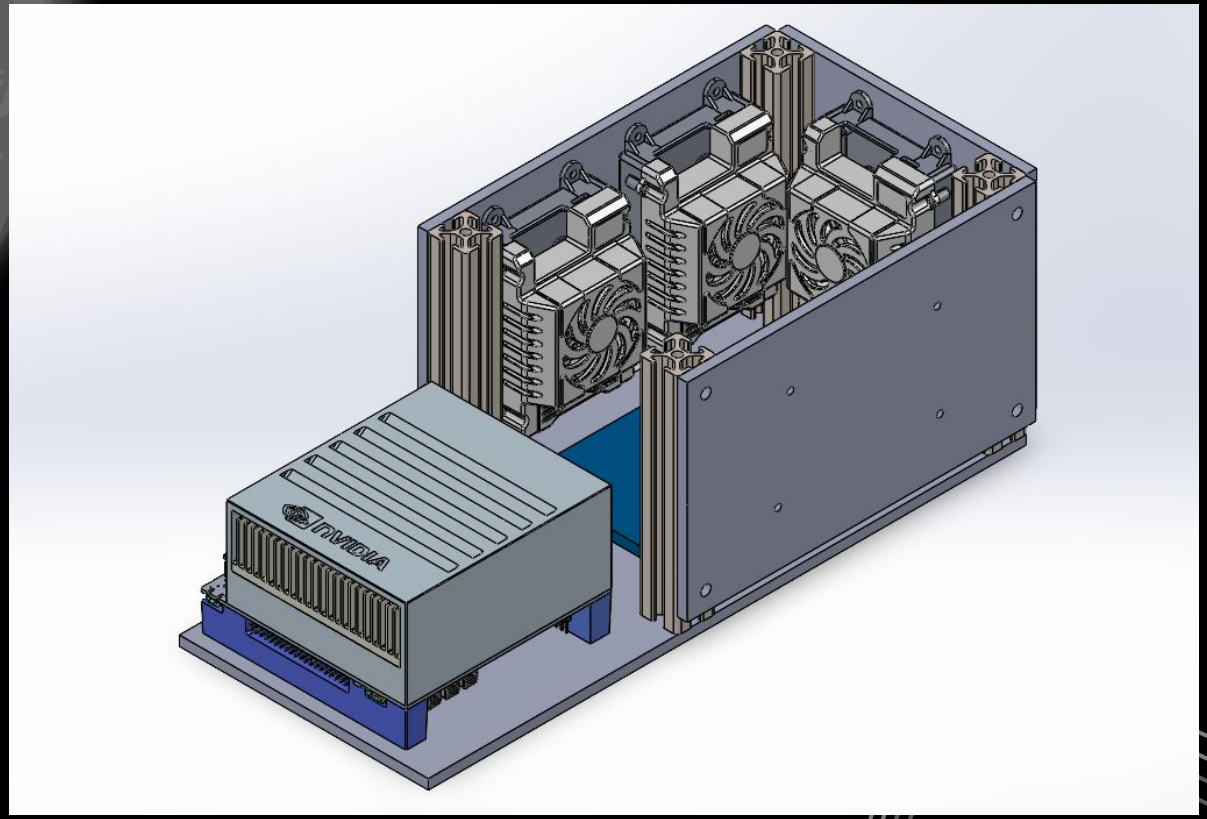
Hardware: Dozer Blade Assembly (T04)

Hardware: Wheel Design Printed (T06)





Hardware: Finalized Preliminary Hardware Setup (T07)



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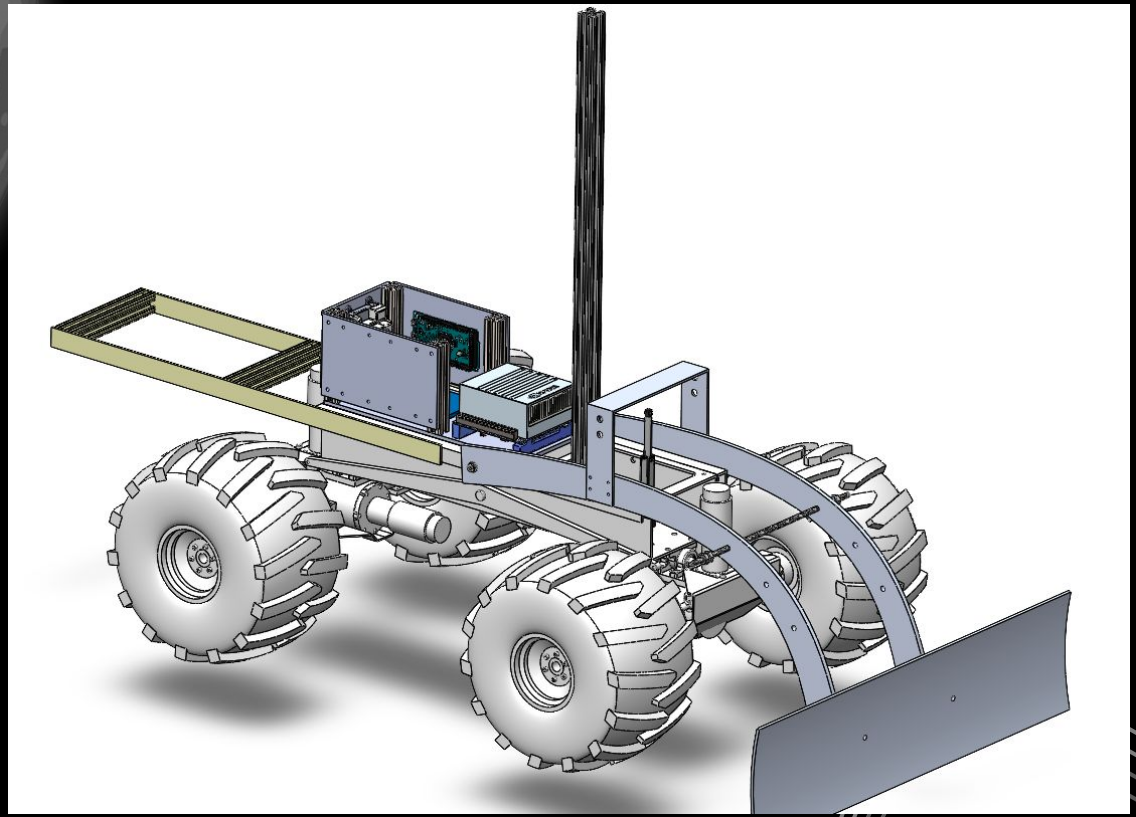


Testing

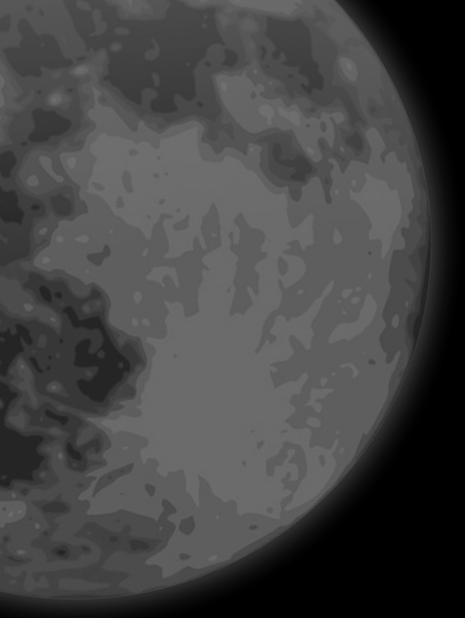
Should we keep this section or include testing in the slides above?

Risk Management

R12	Drive system wear-and-tear causes malfunction	Deepam	Technical	The transmission and steering assembly might be worn out, leading to suboptimal vehicle dynamics, and potentially mechanical failure	Rover drive system fails and may require a lot of repair and maintenance	Thoroughly check the Crater Grader's assembly and carry out maintenance of any worn-out parts Completely replace the assembly parts with the same/similar new parts for better performance and reliability Added limit switches to avoid steering gears to operate beyond their limits
R27	TX2 Integration	William	Technical	Unable to login to TX2 and interface with a LAN network for transmitting data over WiFi ro Jetson	Delay in finalizing localization stack	Set up a new TX2 (Re-flash the TX2). Reach out to previous teams to understand their methodology and retrieve credentials
R28	Electrical hardware finalization	Ankit	Technical	E-box Design dependence on to-be manufactured PDB.	Not meeting the hardware deadline	Use previous knowledge and account for a placeholder in the design
R29	Access to FRC Workshop	Deepam	Logistics	Without access, no hardware fabrication/repairs can be carried out in the absence of Tim	Not meeting the hardware deadline	Try other fab-labs on campus. Request Tim, John or Red for getting temporary access, if not permanent

Issues Log

Issue ID	Date Initiated	Date Resolved	Participants	Description	Options	Resolution	Justification
I01	11/28/2024	12/04/2024	**Team**	Too many performance requirements for SVD.	Have revised performance requirements separately for SVD and FVD.	Revised performance requirements down to 6. Clearly defined SVD and FVD objective split.	Conducted meeting with Crater Grader team and discussed what is feasible and what is not in the given time.
I02	01/20/2025	01/27/2025	**Boxiang Fu**	Unable to login to TX2 chip.	Flash the chip and build docker container from scratch.	Found that chip was used by LunarX team. Got in contact and obtained login details.	No need to reinvent the wheel if not necessary.
I03	02/10/2025	02/14/2025	**Ankit Aggarwal**	Steering mechanism components failed due to wear-and-tear.	Replace broken parts.	Replaced all components of the assembly and fitted new screws and bolts.	Replaced old parts as a precaution for further failure due to wear-and-tear.
I04	02/21/2025	02/24/2025	**Boxiang Fu** **Bhaswanth Ayapilla**	Jetson cannot receive ROS topics published by TX2 chip due to docker driver being set as "bridge" instead of "host".	Change driver settings	Driver setting changed to "host"	This allows docker to communicate with host system
I05	02/25/2025		**Ankit Aggarwal**	E-box Design dependence on to-be manufactured PDB. Can't delay the design as hardware deadline needs to be met	Estimate size based on current PDB and leave enough space		
I06	02/25/2025		**Ankit Aggarwal** **Deepam Ameria**	FRC Workshop Access	1. Request Tim 2. Ask John		



THANKS!

Team Lunar ROADSTER