Lunar Ice Digging System (LIDS)

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Colorado School of Mines Team

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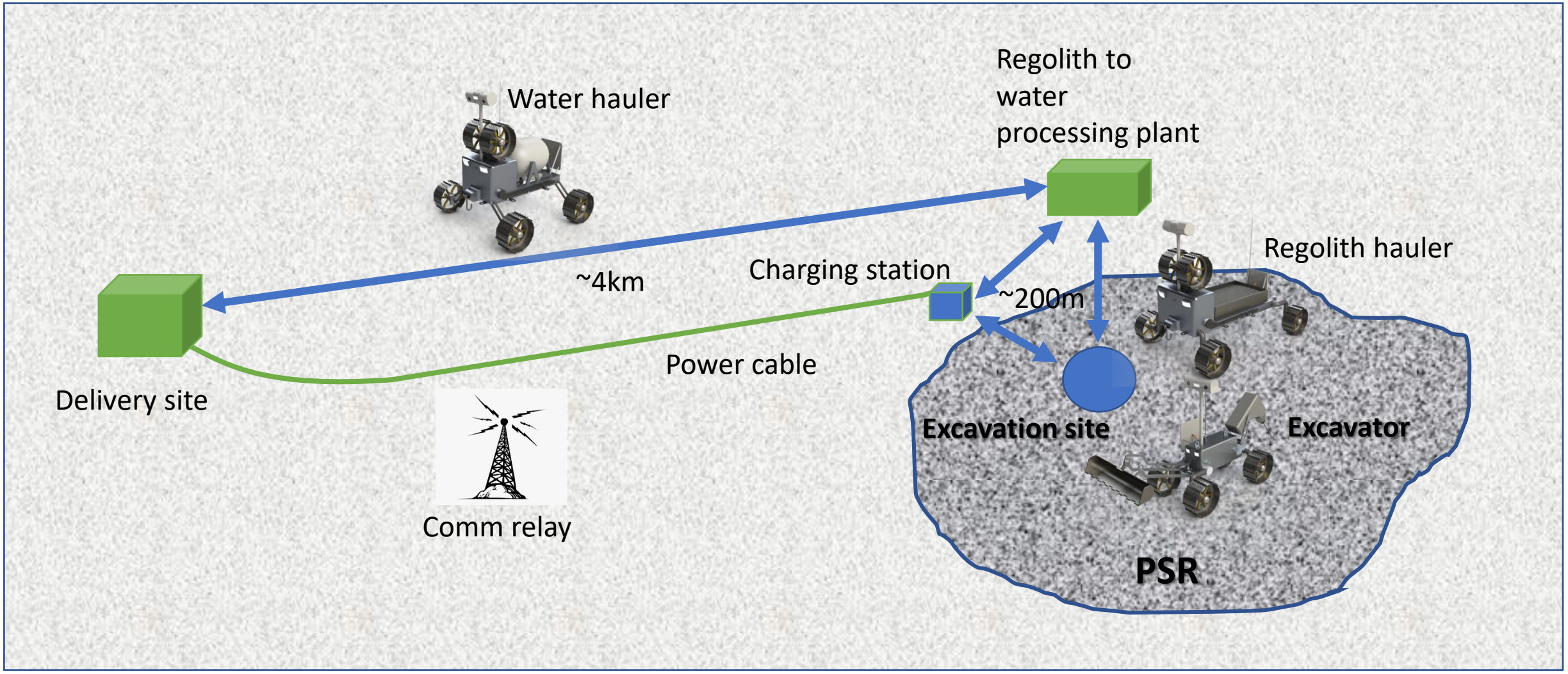
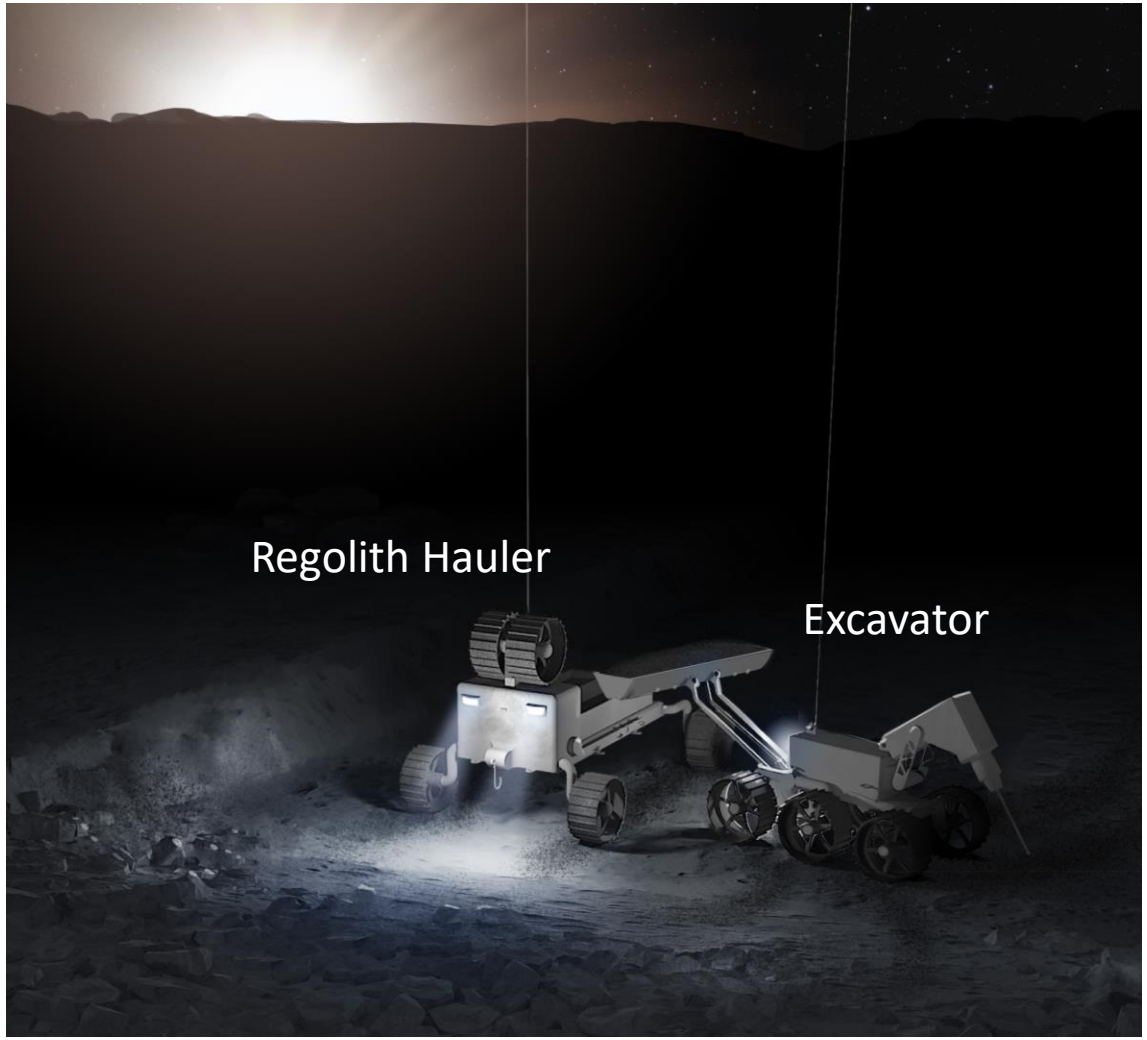
Design Approach

- Lowest cost system that delivers at least 10mT water per year
  - Minimize landed mass (be landable in a single commercial mission, <500 kg)
  - Minimize power consumption
- Minimize risk
  - Maximize use of conventional terrestrial mining approaches
  - Heavy focus on Reliability, Maintainability and Availability (RAM)
- Easily scalable to higher production rates

System Overview

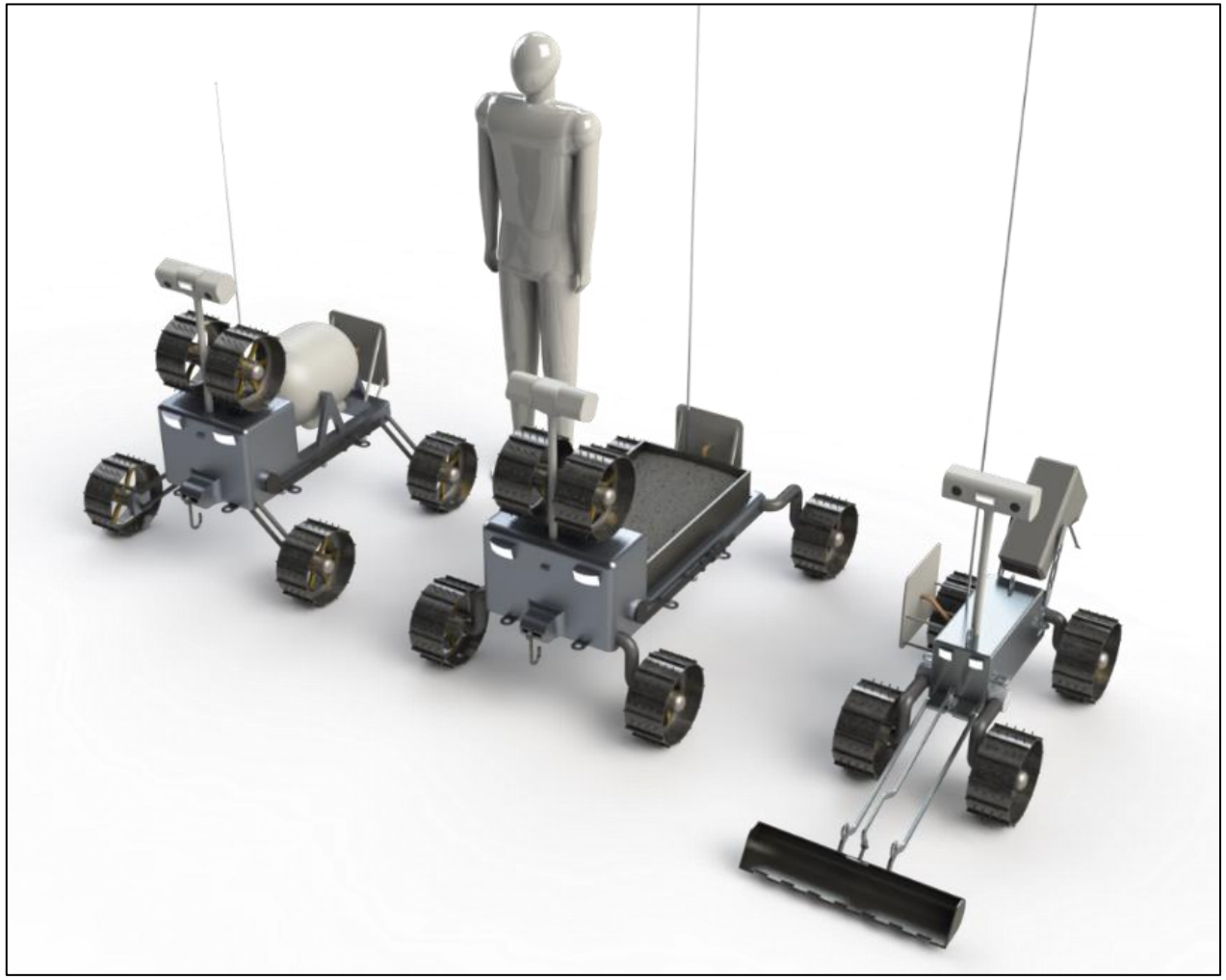


Major System Elements



Major System Elements

- Excavator
  - Jackhammer to break the harder (10wt%) ice
  - Scoop to load into the regolith hauler
- Regolith Hauler
  - Top loading, bottom unloading
  - Manipulator arms for maintenance & repair ops
- Water hauler
  - Liquid water tank
  - Manipulator arms for maintenance & repair ops

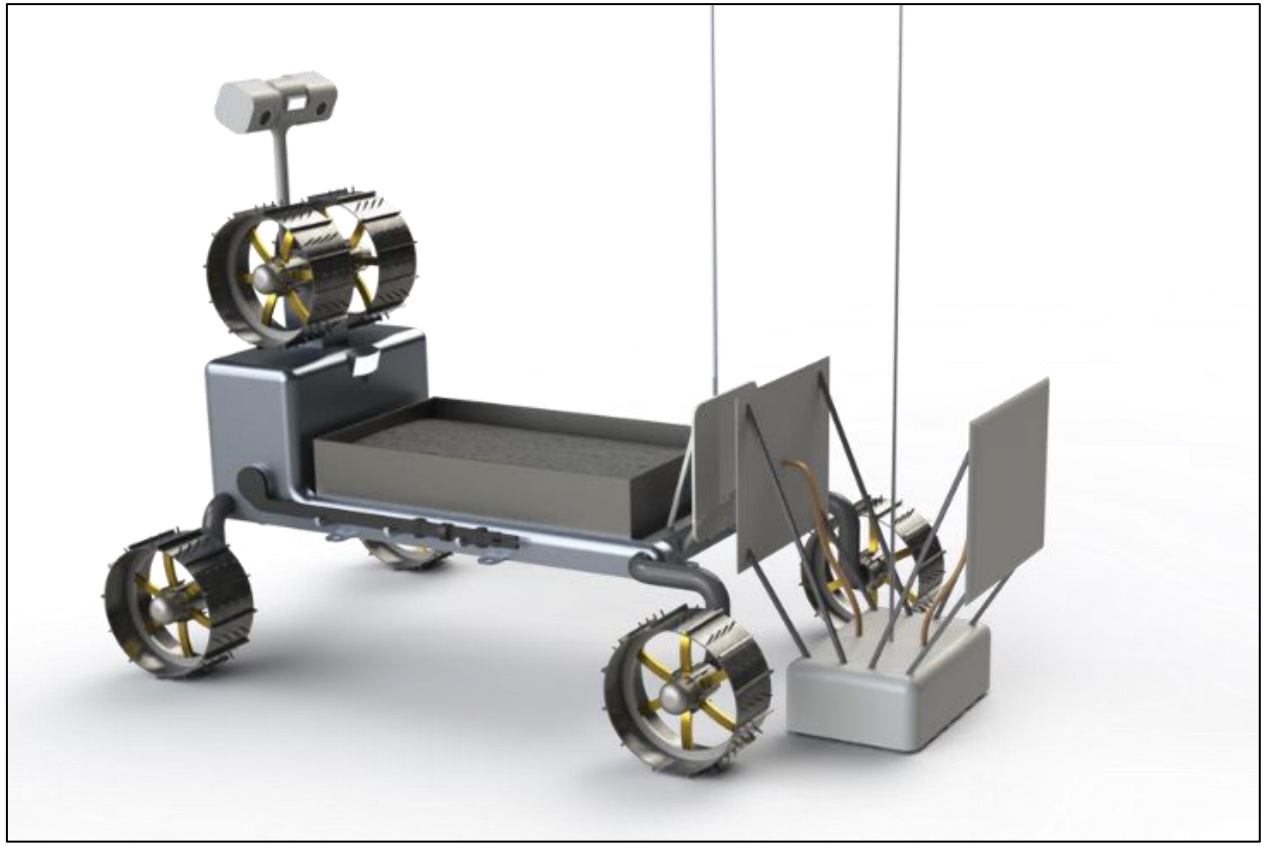


Communications System

- Vehicles teleoperated
- Single comm relay tower provides line of site to delivery site and excavation site

Charging Station

- Wireless charging station
- Two vehicle capacity
- Vertical orientation for dust mitigation



Concept of Operations Overview

Concept of Operations, Production

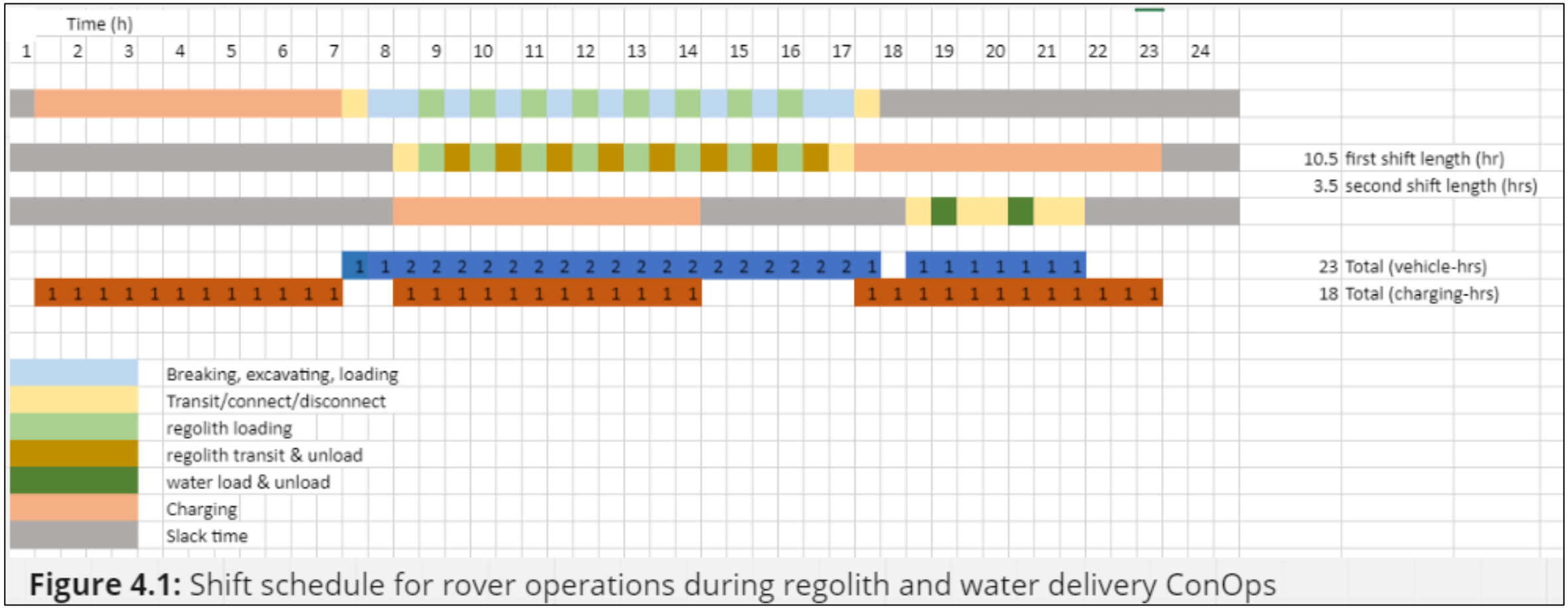
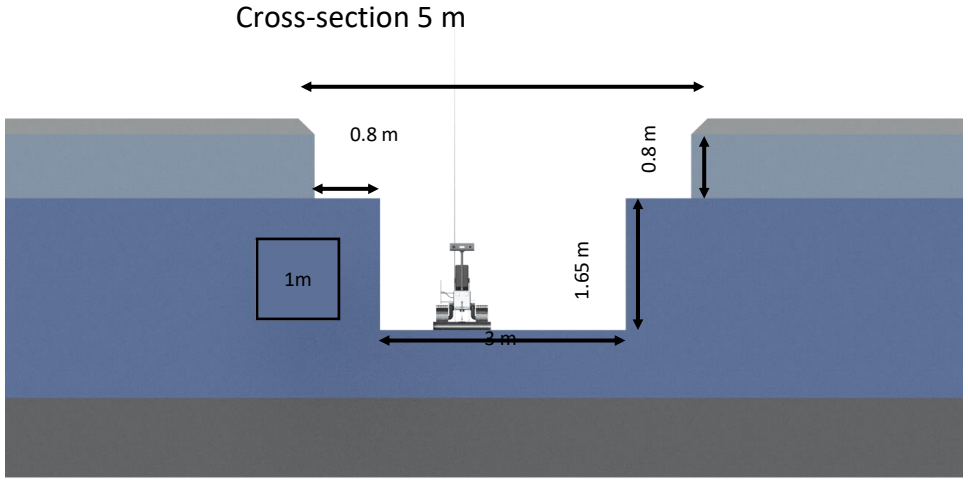


Figure 4.1: Shift schedule for rover operations during regolith and water delivery ConOps

Excavation Plan

- Site location chosen has 5 deg slope
- Excavator scrapes overburden and 4wt% regolith down hill to expose 10wt% regolith
- Excavator works back up hill alternately jackhammering and scooping regolith
- Regolith hauler makes periodic trips to processing facility



Maintenance/Repair ConOps

- Design for high reliability for all systems
  - Mars Rover experience
- Planned replacement of high wear parts
- As needed and emergency repair capability for high wear components
  - Periodic inspections
  - Wheels, jackhammer pick, jackhammer, bucket
  - Wheels common among all mobility systems
- Incorporate manipulator arms on water hauler and regolith hauler
- Water hauler & regolith always carry two spare wheels
- Emergency charging capability and tow hooks built into water hauler and regolith hauler

Mass and Power

	Water Delivered (kg)	Mass (kg)	Energy (kWh)	Specific Mass (kg/kg)	Specific Energy (kg/kWh)
Without Processing facility	11,570	468	1805	24.7	7.2
With Processing Facility	11,570	1168	3485	9.9	3.6

Summary

- The Lunar Ice Digging System (LIDS) offer a low cost, low risk approach to deliver 10mT of water
  - Traditional components, long proven in terrestrial applications
  - Maintenance and repair operations planned in detail
  - Risks identified and mitigated
  - Easily scaled to higher production rates by adding vehicles