



Department Project Information

Department Name	<i>ETCM</i>	Date Submitted	<i>05/06/2022</i>
Project Title	<i>NASA Robotic Mining Competition: Lunabotics 2023 (LUNA_COMP4)</i>	Planned Starting Semester	<i>Fall 2022</i>

Funding

What is the source of funds that will be used to cover all direct costs of this project? *Grant from NASA via NC Space Grant*

Is this source of funds already secured? Yes _____ No *x*

Work Space

Have you secured a lab/work space for the project to be built? Yes *x* No _____

Faculty Mentor/Grading Instructors *

	Name	Email	Phone
1	<i>Aidan Browne</i>	<i>AidanBrowne@uncc.edu</i>	<i>7-5033</i>
2	<i>Michael Smith</i>	<i>Michael.Smith@uncc.edu</i>	<i>7-5058</i>
3			

*List any graduate student that will be working on the project as a grading instructor so that they may be added to Canvas.

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project. Assume 10 hours per week per student.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills:

Discipline	Number	Discipline	Number
Mechanical	<i>4</i>	Electrical	<i>1</i>
Computer	<i>2</i>	Systems	<i>1</i>
Other ()			



Project Overview:

NASA's Robotics Mining Competition: Lunabotics 2023 will be a university-level competition that challenges student teams to design and build autonomous excavation robots capable of traversing a lunar surface and digging and depositing lunar regolith. When mined effectively, this regolith can be a valuable resource for building lunar habitats and producing water, breathing air, and propellants essential for future long-duration lunar missions.

Project Requirements:

Lunabotics has four main aspects:

- 1) Mining: Teams compete with their autonomous rovers in a simulated lunar environment at Kennedy Space Center. Lunabotics rovers compete using BP-1 simulant because it is the most mechanically similar substance to lunar regolith – from roving to digging to mitigating dust.
- 2) Presentation and Demonstration: Lunabotics teams must effectively demonstrate their robot's functionality and communicate their design process, performance goals, safety plan, and design innovations to a panel of NASA & Commercial subject matter experts (SMEs).
- 3) Systems Engineering: All teams are required to submit a thorough systems engineering paper to compete. The paper is judged on topics such as project management, design philosophy, CONOPS, schedule, system hierarchy, requirements, technical and cost budgets, trade studies and conducting major reviews like SRR, PDR and CDR. (This is in place of a similar Senior Design required document).
- 4) Outreach: An important and required component of Lunabotics. Teams inspire others to learn about robotics and have engaged an audience of over 1-million in the past 11 years!

UNC Charlotte has been a participant in the competition for over 11 years. The focus of this project will be significantly modifying the physical design of the existing UNCC Rover (by approximately 50%) to align with the Artemis lunar exploration program; effectively, this means optimizing the subsystems of the current rover. A key requirement this year will be making the rover operate fully autonomously; current autonomous control code will need to be modified and enhanced.

Expected Deliverables/Results:

- Rover to compete in the event at Kennedy Space Center in May
- Final Presentation to NASA
- Systems Engineering paper

Disposition of Deliverables at the End of the Project:

Hardware developed is the property of the mentors and department.

List here any specific skills, requirements, specific courses, knowledge needed or suggested:

- Robotics
- Machine design
- Control systems
- Programming
- CAD
- Machining