

# Project Milestone Report

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As one of the objectives for this milestone, I have created a much longer and more detailed project proposal based on everything I have learned about MoonRanger over the course of this semester. This proposal can be found online at <https://www.andrew.cmu.edu/user/wleemoor/wleemoor-revisedproposal.pdf>

## MAJOR CHANGES

There have been three semi-large changes to the project plan.

1. Data gathered from rover surrogates by the MoonRanger team is available and useful, so using this data for accuracy evaluation has become part of the plan.
2. Having an implementation of a stereo vision algorithm that can run as part of MoonRanger's navigation pipeline early in the semester is a priority. The project schedule has been changed to reflect this.
3. There is no current MoonRanger stereo vision algorithm. So "current MoonRanger stereo vision algorithm" has been dropped from the list of algorithms to test.

## PROGRESS SO FAR

I have attended five weekly MoonRanger Autonomy and Navigation Software team meetings and the MoonRanger Ideation Review. In doing so, I have gained a good understanding of the current state of the MoonRanger project. This understanding has informed my [revised project proposal](#). I have also read 16 papers (10 of these since the first project proposal) to find relevant stereo vision algorithms and approaches and used this knowledge to assemble a list of 10 algorithms that look promising for evaluation during next semester.

## MILESTONE GOALS

I report on my four goals and the extent to which each was achieved:

- Attend relevant MoonRanger team meetings to learn about MoonRanger and its goals and plans for next semester: **Achieved**. I have a good understanding of the state of the MoonRanger project at this time. Some questions remain for me but all are either currently unresolved MoonRanger decisions (e.g. the choice of flight computer) or specifics about how individual algorithms are implemented (e.g. the data representation of the global map).
- Based MoonRanger's goals, plan the timeline for selecting and implementing the stereo vision algorithm during Spring 2020 and identify the criteria for what makes a "good" stereo vision algorithm (accuracy, efficiency, etc.) and how to realistically test these criteria: **Partially Achieved**. The timeline has been planned, but is still highly subject to change during spring semester. Algorithm "goodness" criteria are identified in the [revised project proposal](#), but developing testing methods for these criteria has been deferred to spring semester.
- Study current research in stereo vision and create a shortlist of algorithms that are expected to perform well on these criteria: **Achieved**. I have a list of 10 algorithms that look promising in the [revised project proposal](#) ("Current List of Algorithms to Study" - page 7).

- Write an updated research proposal for a project to assist in selecting and implementing the ideal stereo vision algorithm for MoonRanger during Spring 2020 in a way that fits well with the timeline autonomy team wants for that semester: **Achieved**. See [revised project proposal](#).

## **SURPRISES**

All three changes noted in **Major Changes** would count as surprises. Other than that, I was surprised by the fact that some aspects of the MoonRanger project are still undecided: the choice of flight computer, and details about how the mapping and navigation algorithms will work. These surprises have not adversely affected my project. The flight hardware will be decided in adequate time for my purposes, and the undecided components of mapping and navigation if anything give my project more flexibility and room to make useful recommendations.

## **REVISIONS TO MILESTONES**

All changes affecting milestones were noted in **Major Changes**. The updated milestones can be seen in the [revised project proposal](#) ("Milestones (at the 100% level of success)" – pages 7 and 8). In brief, testing as part of MoonRanger's pipeline was moved forwards and testing on the POLAR database was moved back. "Current MoonRanger stereo vision algorithm" was dropped from the list of algorithms to test.

## **RESOURCES NEEDED**

A detailed discussion of resources needed can be found in the [revised project proposal](#) ("Resources Needed" – pages 10 and 11). In brief, testing on MoonRanger surrogate flight computer hardware is needed and will be available during spring semester. Other than that, all needed resources are freely available online or available for free to CMU students. Test data may be gathered during spring semester with MoonRanger rover surrogates to better assess the algorithm accuracy under certain circumstances, but this data is not essential.