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Lessons Learned in Space Systems (7)

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LESSONS LEARNED IN MANAGING A UNIVERSITY FLIGHT ROVER PROGRAM

**Abstract**

Developing planetary rovers in a university differs from similar efforts in industry and government, as well as from orbital space programs (e.g. CubeSats) in universities. This paper examines Carnegie Mellon University's multi-decadal lunar rover initiative for systems, project, personnel, and program management lessons learned. Lessons are derived from multiple flight and non-flight rover developments, including:

1. the Andy Lunar Rover, which won the Google Lunar XPrize's Milestone Prize for mobility in 2014,
2. the Iris Lunar Rover, which became the first university rover in space in 2024, and
3. the MoonRanger Lunar Rover, which was awarded a NASA flight development contract in 2019.

Each project required unique variations of project management and systems engineering practices throughout its lifecycle. Lessons learned are presented for systems engineering and project management in each project phase. Topics include capacity building, proposal development, successive system design reviews, delivery, integration, and flight.

In addition to project-level management and systems engineering, this paper addresses program-level issues foundational to the distinctions of university planetary rover programs. Identified distinctions include university personnel, resources, culture, and opportunities as well as implications of planetary rover project scopes, schedules, and budgets in this context. Key program efforts include upscaling, knowledge management, and human resources. Various student involvement structures are also discussed. Advice from staff and students spans the recruitment, onboarding, education, contribution, retention, and transition phases and is contextualized within project and program development.