



## NASA SAMPLE RETURN ROBOT CENTENNIAL CHALLENGE

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Demonstrate a Robot  
that can  
Locate and Retrieve Geologic Samples  
from a  
Wide and Varied Terrain without Human Control

Team AERO strives to foster a dedicated and collaborative team, composed of graduate and undergraduate students, to develop and implement innovative robot control, navigation, perception, and manipulation algorithms enabling humans to reach further into space. We aim to demonstrate successful autonomous collection of geologic samples of interest utilizing AERO with the intent of gaining experience in the holistic system design process, improving our robotics engineering skills, and building a kick a\*\* robot. Our vision for AERO requires significant equipment and investments so we are seeking external sponsors.

## SPECIFICATIONS

Dimensions	99 x 67 x 147 cm
Mass	80 kg
Maximum Speed	1.0 m/s
Maximum Obstacle Size	13 cm
Battery	25.6V, 80AH
Battery Life	3 hrs continuous driving
Communications	USB 2.0 / GigE / Wi-Fi / 4G
Modular Software Arch	Ubuntu 12.04, ROS Hydro

## DESIGN REQUIREMENTS

- Navigate a large, previously unmapped area
- Identify samples with minimal/vague description
- Retrieve samples without cross contamination
- Employ only space-compatible technologies

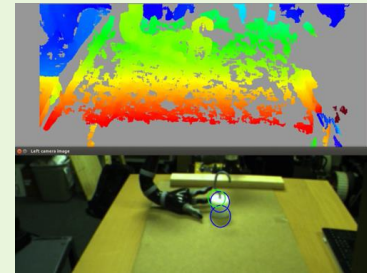
## SENSOR SUITE FOR NAVIGATION AND SAMPLE ID

- Sick LMS151 LIDAR to find landmarks, <20m
- 2x Manta G-095C for stereo vision to find landmarks/hazards
- KVH 1750 Fiber Optic Gyro IMU
- Quadrature Wheel Encoders



## TECHNOLOGICAL INNOVATIONS

- Object classification from abstract characteristics
  - Medium difficulty samples are vaguely described with only abstract, high-level characteristics
  - Highest difficulty samples only have engravings
  - Texture-based generic sample identification
    - Navigation in a large, unstructured area with limited apriori map and obstacle information
    - Manipulation/separation/storage of samples



We are seeking sponsors at all levels to help us meet our budget goals and compete in June 2014.

## PROJECT BUDGET

Mechanical Improvements	\$5,000
Development Tools	\$5,000
3D Printed Rover Wheels	\$5,000
Alternative Sensors	\$5,000
Visual Navigation Marks	\$2,000
Competition Fee	\$3,000
<b>Total</b>	<b>\$25,000</b>

## SPONSORSHIP LEVELS

Platinum Sponsor	>\$25,000
Gold Sponsor	\$25,000 - \$15,000
Silver Sponsor	\$15,000 - \$5,000
General Sponsor	\$5,000 - \$1

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