

AERO

AUTONOMOUS EXPLORATION ROVER



WPI

ROBOT.WPI.EDU/ROVER



NASA'S SAMPLE RETURN ROBOT CENTENNIAL CHALLENGE

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

Eight graduate and four undergraduate students from WPI and Rutgers are developing AERO to participate in the NASA Sample Return Robot Centennial Challenge. AERO must autonomously navigate a large outdoor area, collect various predetermined samples, and return them to the starting area.

AERO consists of a Clearpath Robotics Husky A200 mobility platform and Kinova Jaco arm for handling sample retrieval. With 6-DOF and three underactuated fingers, the Jaco arm can retrieve all the samples. A LIDAR, multi camera vision system and an inertial measurement unit form the sensor suite on-board

SPECIFICATION	
Dimensions	99 x 67 x 56 cm
Mass	60 kg
Payload	20 kg
Maximum Speed	1.0 m/s
Maximum Obstacle Size	13 cm
Modular Power Interface	5V / 12V / 24V
Modular Communications	USB 2.0 / GigE / Wi-Fi / 4G
Software	

DESIGN REQUIREMENTS

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

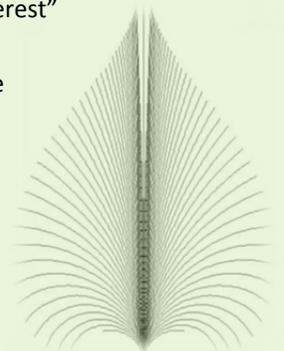
NAVIGATION AND SLAM

- Sick LMS151 LIDAR finds landmarks, radius <20m
- 2x Manta G-095C for stereo vision finds landmarks/hazards
- SLAM algorithm matches LIDAR and vision identified landmarks



TECHNOLOGICAL INNOVATIONS AND VISION

- Object classification from abstract characteristics
 - The more difficult samples are vaguely described with abstract, high-level characteristics
- Real-time grass occluded object identification
 - Objects will sink into the grass and robust methods to identify grass occluded objects will be needed
- Texture-based “samples of interest” identification
 - The most difficult samples are only marked with small engravings and do not belong in the environment.
- Tentacle-based driving with fuzzy logic arc selector
- Landmark extraction



We are seeking sponsors at all levels to help us meet our budget goals and compete in June 2013.

PROJECT BUDGET

Husky A200	\$15,500
Jaco Arm	\$42,500
Sick LMS151	\$5,500
IMU	\$5,000
Computers	\$6,000
Integration	\$7,500
Entry Fee	\$3,000
Total	\$85,000

SPONSORSHIP LEVELS

Platinum Sponsor	>\$25,000
Gold Sponsor	\$25,000 - \$15,000
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