USMART, Upenn Space, Mobile, and Autonomous Robotics Team, is comprised of members with diverse experiences and demographics. We have developed a rover for varying terrains and sample object shapes. Autonomous and semi-autonomous systems achieve high control and reliability in a changing environment.

MEMORABLE ACADEMIC OUTREACH MOMENTS
USMART organized and participated in a range of outreach programs, including Undergraduate Space and Robotics Day, National Robotics Week GRASP Open House, Philadelphia Science Festival, and Upper Bound Math and Science SeaPerch robot building.

STEREO RIG
- Experimented & future possibility: Pair of GoPro HERO2 cameras, 180° field of view
- Each with Eye-Fi wireless SD card
- Augmented Reality marker recognition, 3D projection to localize marker

SENSORS & ODOMETRY
- Hokuyo UTM-30LX, 30 m, 270° range, EKF integration of IMU, LIDAR, encoders, Flea and Logitech cameras
- 2D localization
- 3D OctoMapping

MANIPULATION ARM
- Spring steel brushes, laser cut ABS (Acrylonitrile butadiene styrene)
- 4 degrees of Freedom

RAKED RAMP
- ABS laser cut, Spring steel curved rakes assist arm-scooped object entrance
- Returns object into robot

LIGHT WEIGHT CASE
- Aluminum, houses all electronic hardware
- Mountable surface for CLEAR 4G Hotspot Apollo and camera

MAC MINI
- 2.5GHz dual-core Intel Core i5, 2GB DDR3 RAM, Ubuntu 10.04
- Home to tele-op, control, vision

FOUR-WHEEL DRIVE
- 1” thickness and 9” diameter provide resistance to bumpy terrains
- Each wheel independently controlled, fail-safe redundancy

POWER, ELECTRONICS
- Lithium polymer, 2 hours in operation
- SyRen 10A Regenerative Motor Control board, recharge while wheel breaks

STRESS ANALYSIS
- Static nodal stress and static displacement analyses
- Blue = low stress
- Displacement: High stress only on motors