

# Lobokhod

## The University of New Mexico's Robotic Mars Rover

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### Introduction

Lobokhod is one of the University of New Mexico's entries in the American Association for Artificial Intelligence (AAAI) Sixth Annual Mobile Robot Competition. Lobokhod will be competing in the "Find Life on Mars" event. Lobokhod is named in honor of the Lunokhod series of robotic rovers, which were the first robotic rovers to explore an astronomical body other than the Earth. Lunokhod 1 landed on the moon in November 1970, followed shortly by Lunokhod 2.

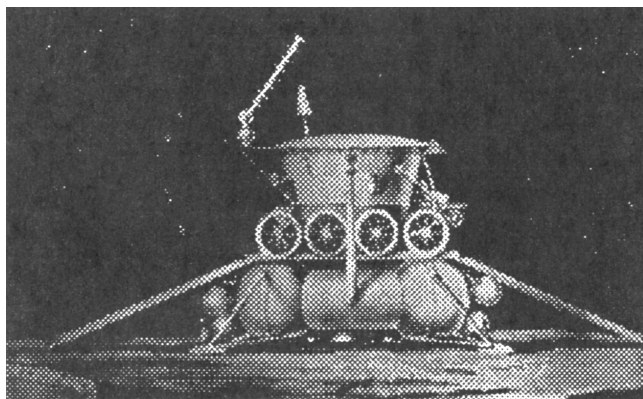


Figure 1. Lunokhod 1. (Illustration courtesy of NASA)

Lobokhod joins a family of previous UNM mobile robot competition entries, including Lobotomous (which is being entered in the "Home Vacuum" and "Hors d'oeuvres Anyone?" events this year) and Lobot.

### The Lobokhod Team

Lobokhod is being built by a team of UNM undergraduate students, led by a graduate student (Dan Stormont). This project is a voluntary project for all of the participants, which demands a lot of their free time. The mobile robot competition teams are being sponsored by Dr. Greg Heileman and the Lobotomous team is receiving additional help from Drs. Ray Byrne and Chaouki Abdallah.

### Hardware

Lobokhod is being built on a tricycle chassis, using a differential drive with one caster. The two drive wheels are driven with DC gear motors. The main body consists of a 13"x17"x5" aluminum chassis box. This gives

Lobokhod a 15" wheelbase. The body houses two 12 volt batteries (for 24 volt operation), DC-DC converters for the computer and onboard electronics, and the motor amplifier. The onboard computer consists of a STD-Bus rack containing an 80286-compatible main processor. Lobokhod is using an 80286 laptop computer for the input/output to the STD-Bus PC. The current plans are to use a color camera for capturing the images of obstacles and objects encountered, and Polaroid ultrasonic sensors to avoid collisions. The Lobokhod team is investigating the use of multiple processors to distribute the processing load for the sensors, path planning, and robot control. The final decision on the processor architecture used will be driven largely by parts availability and the complexity of interfacing multiple processors. Lobokhod will be provided with the capability to identify objects (either through a speech generation system or a set of visible indicators). Lobokhod is being designed to accept a manipulator, but it won't be installed until the rest of Lobokhod's functions are working to the team's satisfaction.

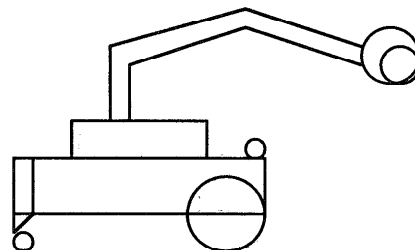


Figure 2. Conceptual illustration of Lobokhod.

### Software

The software for Lobokhod will be a mixture of 80x86 assembly language and ANSI standard C. C will be used wherever possible. Software needs to be developed for controlling Lobokhod's electromechanical systems (i.e., the motors and manipulator arm), path planning, image processing and recognition, obstacle avoidance, and object interception. The Lobokhod team is currently researching the algorithms to be used for path planning, image recognition, and robot control based on sensor inputs. Some of these algorithms are going to be simulated prior to implementation using Omega. Omega, by Origin software, is a robot tank simulation game with some unique capabilities which make it useful in simulating a

mobile robot. The game has full editing capabilities for the battleground (the "play area" for the robot) and the Artificial Intelligence programming (the algorithm used), as well as some limited editing capabilities for the tank chassis. Using these editing capabilities, a mobile robot can be simulated to a reasonable level of fidelity in an environment similar to the contest conditions. This allows various algorithms to be tested for suitability prior to being implemented on Lobokhod.

### **Conclusion**

The Lobokhod team faces a daunting challenge in getting Lobokhod ready for the AAAI '97 mobile robot competition. We expect to be able to field a competitive robot by July, but even if we don't, the learning experience will be invaluable to every member of the Lobokhod team.