# FPGA Phone Home:

## Final Project Abstract

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Imagine that NASA's Curiosity rover suffered a catastrophic failure to its guidance and communications systems. All that remains of the system is the backup IR communication receiver and the debug audio-out constant ping pulse which was accidentally not removed before launch. The only system close enough to communicate with Curiosity is the now stationary Spirit rover which got stuck in some soft soil in 2009 (suspend disbelief that both the rover came back on-line and the debug signal was left installed) which could then communicate back to earth. How could NASA control the robot's movements and keep the mission going?

This project is an exploration of a solution to that problem. Namely, I want to have the "rover" ping home, sending out a pulse periodically. I then want to use a stationary FPGA and 3 microphones to use the delay in the reception of the signal to triangulate the position of the rover. I then want to calculate the path the rover needs to take to reach the destination and send the command to the rover over IR and have a second FPGA on the "rover" body interpret the commands and head in the right direction.

I think there are a couple of ways in which this project can be modularized in order to provide mid-way success points. For starters I think the minimum viable product would be the ability to calculate the position of the "rover" from the main FPGA. The next level would be then to calculate the direction and path the "rover" should take to reach a pre-programmed target. The level on top of that would allow for calculation of distance to an arbitrary target location. Then it would be able to send a command to the "rover." Finally it would be to control the rover and actually have it move to that location. This last step would also require a calibration step to determine the orientation of the "rover" to direct it appropriately. For debug purposes it may also be needed to make a VGA output to visualize where the main FPGA thinks the target and "rover" are located.

I think this project is both do-able and quite complex in its final iteration. I would plan to leverage my work in Lab 5b and the alarm on Lab 4 for both the ping and the IR commands. I already have a two motor tank platform that could be used as the "rover." The debug graphics could build off of Lab 3. The heavy lifting would be in the audio ping triangulation and in the actual control of the robot.