

1. **Research Title:** “Odor-Based Guidance and Navigation System for Autonomous Vehicles.”

2. **Individual Sponsor:**

Dr. Jacob L. Campbell AFRL/SNRN,
AFRL/SNR Bldg 620
2241 Avionics Circle
WPAFB, OH 45433-7333
Jacob.campbell@wpafb.af.mil

3. **Academic Area/Field and Education Level:** Electrical Engineering and Computer Science/Multi-sensor integration and processing (MS or Ph.D. level)

4. **Description:** The proposed project will develop an autonomous, surveying and scouting system that tracks a predefined odor through a “ventilation” system. The odor tracking system should mimic biological systems that use odor to track and intercept objects of interest. The autonomous vehicle will be a small robotic vehicle either wheeled, tracked, or with legs. In order to navigate, each of the robots will utilize onboard sensors to sense the odor, CMOS camera for vision, microphone, and, at times, transmitted commands. In addition, each robot will be fitted with a position sensor platform. A base station will be established and will consist of a positioning device, a radio transceiver, a human interface, and a computer equipped with software to support sensor data collection, storage, image processing and map generation, path projection, data transmission, and human input.

The main system will consist of an odor-seeking robotic-vehicle. The robot will survey an area autonomously, transmitting internal camera images, or possibly images from an externally mounted camera, via wireless LAN. Also, the platform attached to the robot will obtain position data from a radio-based positioning system. The platform will include the odor detecting device, a positioning device, radio transceiver, power supply, and possibly an external, high-resolution video camera. The base station will perform the following functions: (1) track and analyze position information, sensor data, and camera images from each robot, (2) render a three-dimensional map based upon the images and data from the lead robot, (3) recognize a target.

5. **Objectives:** (1) Complete a working prototype of an odor-based navigational and guidance platform, fitted to an autonomous vehicle and including a radio modem for data transfer and its own power supply. (2) Integrate the navigational information, sensor data, and CMOS images into a software system capable of generating a three-dimensional map of a robot’s route and capable of communicating the shortest path from the base station to the robot. (3) Develop software for autonomous target recognition..

6. **Research Classification/Restrictions:** None at this time.

7. **Eligible Institutions:** DAGSI