Optical Landing System

Sponsor's Name: Lockheed Martin
Sponsor's General Mission or Business Statement: Headquartered in Bethesda, Maryland, Lockheed Martin employs about 140,000 people worldwide and is principally engaged in the research, design, development, manufacture and integration of advanced technology systems, products and services.
Sponsor's Advisor, Title, and Phone Number: Scott Morgan, Senior Staff Engineer, 651.456.2304
Sponsor's Address: 3333 Pilot Knob Road, Eagan, MN 55121
University of St. Thomas School of Engineering Academic Advisor: Dr. Christopher S. Greene
Team Member Names: Adam J. Becker (EE), Mark E. Butenhoff (EE), Aaron R. Ewing (EE), Matthew R. Gartmann (ME), Thomas J. Flaherty (EE), Luke F. Westman (EE)
Senior Design Clinic I-II (ENGR 480-1) Project Description: To design and develop an optical landing system for an Unmanned Aerial Vehicle (UAV) that shall send flight control inputs in order to land the UAV autonomously in a designated landing zone.

Major Design Requirements:
1. Operable 24 hours a day
2. Operate in light rain and in head winds less than 20 miles per hour
3. Sensor must be 'eye-safe' and weigh less than 100 grams
4. Sensor must be powered by available 5 Volts and maximum 800 mA
5. Ground Based Unit (GBU) must operate for 6 hours on fully charged batteries
6. System shall control glide slope, glide path, and throttle after taking control
7. Ground Based Unit shall be portable and weather resistant
8. Engine power must be off before landing
9. UAV must land within an ellipse 60' long by 40' wide centered around the GBU
10. User alert must be heard up to 20' away

Senior Design Project Summary:
Unmanned Aerial Vehicles are a fielded and proven unmanned aerial system. They offer autonomous reconnaissance and surveillance capabilities, including terrain avoidance and dynamic flight plan retasking. Currently, UAVs primarily operate through GPS and can be cumbersome to fly for inexperienced pilots. The project's goal was to design an optical system to automate the landing stage of the UAV. Through automation, maintenance costs associated with crashes can be reduced and human pilots are no longer required to land the UAV manually. Our design transmits flight control signals to the UAV up to a rate of 90 hertz in order to control the glide slope and path guiding the UAV to a safe landing. In the future our design could be integrated with GPS to allow complete automation moments after take-off to landing.

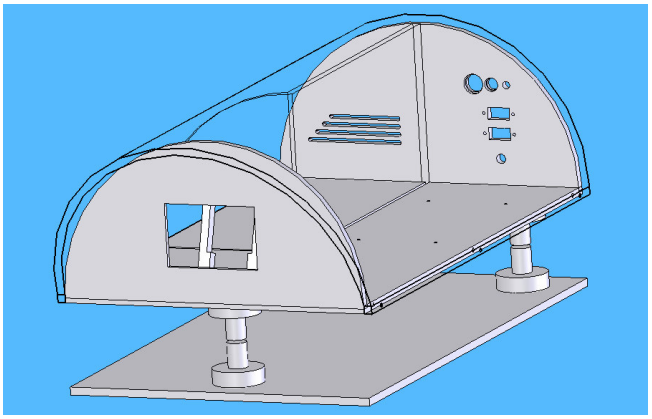

Figure 1 – Solidworks drawing of GBU (Top removed)

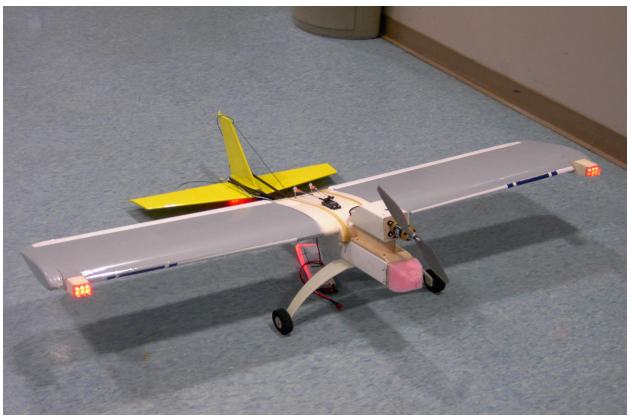

Figure 2 – Unmanned Aerial Vehicle (R/C)