Autonomously Controlled E-Maxx: ACE

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In recent years, national disasters and global conflict have provided no shortage of dangerous search, rescue and reconnaissance missions to be performed by specialized personnel. Addressing the desire to spare human beings from these dangerous missions there has been a growing emphasis on the development of low-cost autonomous vehicles. Continuing the tradition of autonomous vehicle development at Embry-Riddle Aeronautical University, the Autonomously Controlled E-Maxx, or ACE, seeks to provide on the ground search and reconnaissance capabilities in a low cost scalable platform.

As a ground vehicle, ACE is designed to autonomously navigate through a series of GPS waypoints while avoiding obstacles in its path. Upon reaching areas of interest, ACE is designed to employ search patterns to locate and provide both visual and thermal reconnaissance on targets or areas of interest. During mission, the ground vehicle remains in constant communication with a student designed ground station, relaying live video feed, GPS coordinates, directional headings and thermal readings as well as other meaningful information to human operators.

Unmanned Ground Vehicles (UGVs) such as ACE are capable of providing close-in interactions with targets that are not possible with an aerial platform. However, ACE is designed to employ the strengths of unmanned aerial vehicles by operating in concert with the previously designed Embry-Riddle AutoNAS aerial vehicle. Through interaction with the vehicles' ground station databases, targets can be designated from the aerial vehicle and the UGV deployed to provide further investigation. This interaction and other capabilities can be supervised from the ground station which provides a graphical user interface to simplify the operation of the vehicle.

On the organizational side, ACE is composed of a multi-disciplinary team consisting of fifteen engineers organized into functional design teams. Design team roles vary from embedded operating system development to quality assurance engineers responsible for overseeing the adherence to a defined TSP (Team Software Process) based development process. Seeking to keep costs low and utilize knowledge previously gained, effort was put forward to utilize free and open-source software development tools as much as possible. In addition, commercial off the shelf components were chosen to construct the ground vehicle and modular design techniques are employed to improve system maintainability. A sample of key technologies employed include the Propeller 8-core multiprocessor, field programmable gate array (FPGA) utilization and a diverse database system employing Pyro (Python Remote Objects) to manage remote procedure calls.

As development of the system continues, additional capabilities are added and verified according to the overall project task plan. The final goal of the project is not only to provide all desired functionality, but to create a system flexible and scalable enough to allow future design teams to add even more diverse functionality.