Senior Design Project in Electrical & Computer Engineering

Shipboard Relative GPS for Vertical Take-off and Landing Unmanned Aerial Vehicles

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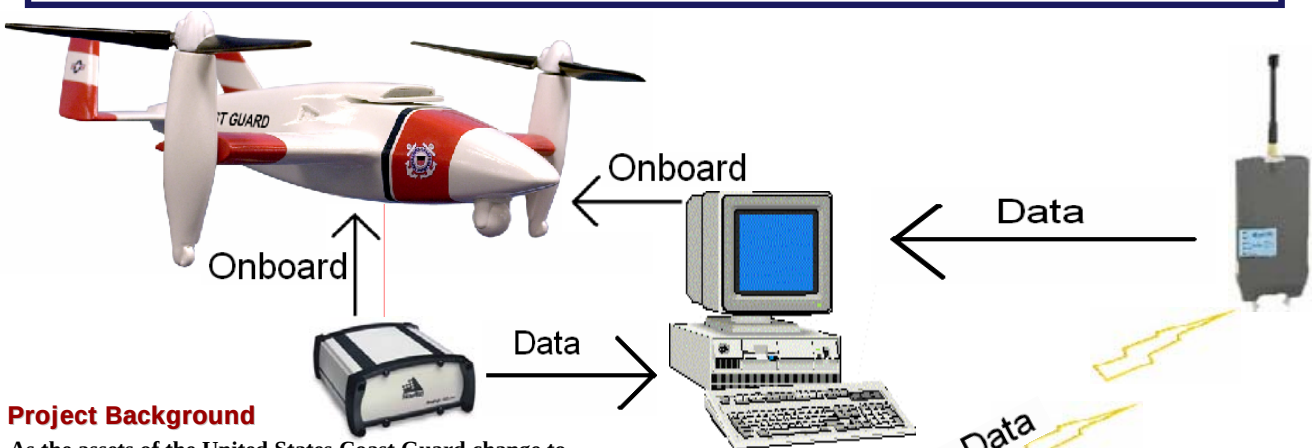
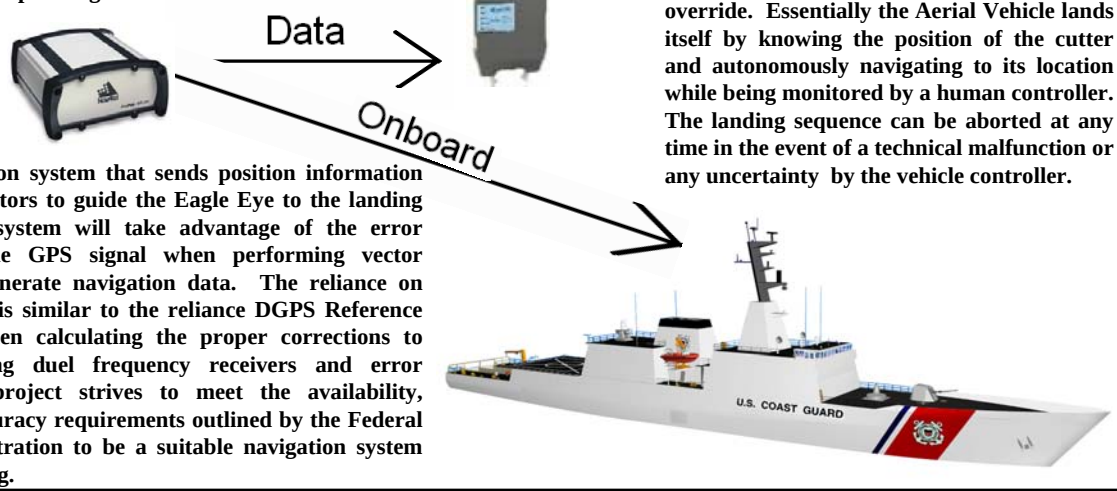


Project Background

As the assets of the United States Coast Guard change to meet the country's evolving needs, technologies must be developed that support these systems aboard Deepwater and Legacy cutters. One such asset is the Eagle Eye, a unmanned aerial vehicle capable of vertical take offs and landings similar to those performed by a helicopter. Additionally the Eagle Eye has the ability to hover and maintains the increased speed and range characteristics of fixed wing aircraft. Developing an automated take-off and landing system reliant upon Shipboard Relative GPS for the Eagle Eye utilizes technologies already harnessed by the Coast Guard. Additionally, an automated take-off and landing system eliminates the most difficult parts of controlling an unmanned aircraft. The introduction of such a system reduces the skill set necessary for controlling an Unmanned Aerial Vehicle from one requiring comprehensive schooling to a skill set comparable to operating the 73-RADAR.

Project Design

Duel frequency GPS receivers located aboard the Aerial Vehicle and the Cutter send position information to the Navigation Center (computer) located aboard the Aerial Vehicle. The position information from the cutter is transmitted along a line of sight path utilizing very high frequency radio wave data transmission. The Navigation Center aboard the Aerial Vehicle calculates a three dimensional navigation vector to the flight deck of cutter, but maintains a manual override. Essentially the Aerial Vehicle lands itself by knowing the position of the cutter and autonomously navigating to its location while being monitored by a human controller. The landing sequence can be aborted at any time in the event of a technical malfunction or any uncertainty by the vehicle controller.



Project Goals

Create a navigation system that sends position information and calculates vectors to guide the Eagle Eye to the landing platform. This system will take advantage of the error correlation in the GPS signal when performing vector calculations to generate navigation data. The reliance on error correlation is similar to the reliance DGPS Reference Stations have when calculating the proper corrections to broadcast. Using duel frequency receivers and error correlation the project strives to meet the availability, integrity, and accuracy requirements outlined by the Federal Aviation Administration to be a suitable navigation system for aircraft landing.