DEVELOPMENT OF AN AUTONOMOUS UNMANNED AERIAL VEHICLE FOR AEROBIOLOGICAL SAMPLING

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ABSTRACT

The ability to detect, monitor, and forecast the movement of airborne plant pathogens in agricultural ecosystems is essential for developing rational approaches to managing these habitats. We developed an autonomous (self-controlling) unmanned aerial vehicle (UAV) platform for aerobiological sampling tens to hundreds of meters above agricultural fields. Autonomous UAVs have the potential to extend the range of aerobiological sampling, improve positional accuracy of sampling paths, and enable coordinated flight with multiple aircraft at different altitudes.

We equipped a Senior Telemaster model airplane with two spore-sampling devices and a MicroPilot autonomous system, and we conducted over 60 autonomous microbe-sampling flights at Virginia Tech's Kentland Farm. To determine the most appropriate sampling path for aerobiological sampling, we explored a variety of different sampling patterns for our autonomous UAVs including multiple GPS waypoints plotted over a variety of spatial scales.

We conducted a total of 25 autonomous aerobiological sampling flights for five different aerobiological sampling patterns. The pattern of a single waypoint exhibited the best flight characteristics with good positional accuracy and standard deviations in altitude from 1.6 to 2.8 meters. The four point pattern configured as a rectangle also demonstrated good flight characteristics and altitude standard deviations from 1.6 to 4.7 meters.

BIOGRAPHICAL SKETCH

Ben was born and raised in Nickelsville, Virginia, and attended Southwest Virginia Community College for the first two years of undergraduate. After which he transferred to Virginia Tech to finish his undergraduate degree. At Virginia Tech, he has worked on many unmanned systems projects including the student UAV team to compete in AUVSI's annual competition (2005-2006) and doing undergraduate research with Dr. Reinholtz on the ONR vehicle teaming project (2006). During graduate school, Ben has worked with the Department of Plant Pathology for the work presented in this thesis with a defense date of May 8, 2007. He also works for Dr. Reinholtz as a graduate research assistant on the ONR vehicle teaming experiments and is a teaching assistant for the student UAV competition team (2006-2007). When he is not doing research, Ben enjoys mountain biking, hiking, and hanging out with friends.

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I would also like to thank my family for their love and support throughout my academic career because without them I would not be who I am today.

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