

Opportunity Title: Advanced Actuation, Dynamics, and Controls Development for Thrust Based sUAS Enhancements

Opportunity Reference Code: ARL-C-VTD-300088

Organization DEVCOM Army Research Laboratory

Reference Code ARL-C-VTD-300088

Description About the Research

Quadrotors are one paradigm in a larger field of thrust based flight systems used in the sUAS vehicle category. These systems are dynamically simple and easy to fly under most conditions with the appropriately applied flight controllers and sensor hardware. The classic designs employed are based on variable speed fixed pitch propeller systems with multiple propellers mounted in a single plane around a central body. These propellers are cross diagonally paired, one spinning clockwise (cw) and the other counter-clockwise (ccw) to balance out the torques on the body. With these constraints the dynamics are underactuated and body orientation is tied to translation (i.e.) pitching forward yields moving forward. While a simple system, these design realities can inherently limit the flight profiles and the ability to reject forces as well as exert them to accomplish various missions. With the limitations of these platforms as stated, it is proposed that new vehicle dynamics be explored as linked to advanced maneuvers and controls to better enable more robust flight and new mission possibilities. By applying new vehicle designs, dynamics, and linked controls the ability to reject forces under certain conditions such as wind around a building or landing on a moving vehicle could be more possible than compared to current systems. Practical tests will be aimed at experiments to study the improvements the developed vehicle dynamics and controllers have to these ends.

ARL Advisor: James Dotterweich

ARL Advisor Email: james.m.dotterweich.civ@mail.mil

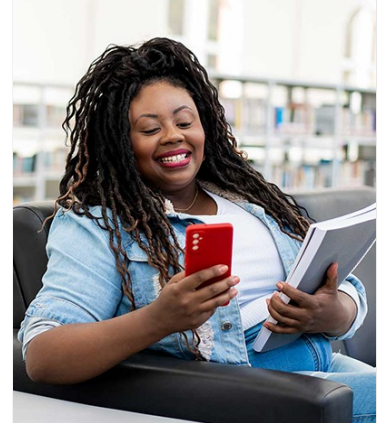
About VTD

The CCDC-Army Research Laboratory's Vehicle Technology Directorate (VTD) is the principal Army organization responsible for the pursuit of mobility-related science and technologies leading to advanced capabilities and improved reliability for Army air and ground vehicles. VTD leads the ARL Major Laboratory Program in mobility and the RDECOM Technology Focus Team in mobility and logistics. The technology focus areas within the ARL and RDECOM programs have been defined as platform, propulsion, intelligent systems and logistics.

The VTD mission is accomplished through in-house basic and applied research, and from collaborations with other ARL functions, RDECOM, Navy, Air Force, academia and industry leaders. The mission is enhanced through teaming with and leveraging of research efforts associated with Collaborative Technology Alliances (CTAs) and Multidisciplinary University Research Initiatives (MURIs). For example, VTD is actively involved with two CTAs (Robotics and Micro Autonomous System Technologies), several cooperative agreements, and a unique partnership with the National



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Aeronautics and Space Administration (NASA) at the Langley Research Center in Hampton, VA and the Glenn Research Center in Cleveland, OH.

About ARL-RAP

The [Army Research Laboratory Research Associateship Program](#) (ARL-RAP) is designed to significantly increase the involvement of creative and highly trained scientists and engineers from academia and industry in scientific and technical areas of interest and relevance to the Army. Scientists and Engineers at the CCDC Army Research Laboratory (ARL) help shape and execute the Army's program for meeting the challenge of developing technologies that will support Army forces in meeting future operational needs by pursuing scientific research and technological developments in diverse fields such as: applied mathematics, atmospheric characterization, simulation and human modeling, digital/optical signal processing, nanotechnology, material science and technology, multifunctional technology, combustion processes, propulsion and flight physics, communication and networking, and computational and information sciences.

A complete application includes:

- **Curriculum Vitae or Resume**
- **Three References Forms**
 - An email with a link to the reference form will be available in Zintellect to the applicant upon completion of the on-line application. Please send this email to persons you have selected to complete a reference.
 - References should be from persons familiar with your educational and professional qualifications (include your thesis or dissertation advisor, if applicable)
- **Transcripts**
 - Transcript verifying receipt of degree must be submitted with the application. Student/unofficial copy is acceptable

If selected by an advisor the participant will also be required to write a **research proposal** to submit to the ARL-RAP review panel for :

- Research topic should relate to a specific opportunity at ARL (see [Research Areas](#))
- The objective of the research topic should be clear and have a defined outcome
- Explain the direction you plan to pursue
- Include expected period for completing the study
- Include a brief background such as preparation and motivation for the research
- References of published efforts may be used to improve the proposal

A link to upload the proposal will be provided to the applicant once the advisor has made their selection.

Questions about this opportunity? Please email

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ARLFellowship@orau.org

- Eligibility Requirements**
- **Citizenship:** U.S. Citizen Only
 - **Degree:** Doctoral Degree.
 - **Academic Level(s):** Any academic level.
 - **Discipline(s):**
 - **Engineering** ([6](#) )