Adam R. Gerlach

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Innovative | *Interdisciplinary* | *Impactful*

Experience

Air Force Research Laboratory — *WPAFB, OH*

Senior Research Aerospace Engineer — *Jan 2020 — Present*

- Led the ideation, planning and technical execution of research, development, and test initiatives to provide long-term mission impact
- Managed a multidisciplinary international team of researchers, ensuring aggressive technical, schedule, and financial goals were met
- Developed autonomy technologies for decision making and optimization under uncertain and incomplete information
  - Enabled improved system performance and risk management
  - Extended the real-world viability of autonomous systems in complex environments

Research Aerospace Engineer — *Feb 2016 — Jan 2020*

- Transformed cargo delivery mission planning by developing mission-specific planning criterion, methodologies, and risk measures
- Led a successful multiyear cargo delivery flight-test campaign that met all technical, schedule, and cost objectives
- Negotiated no-cost R&D agreements with industry partners to develop, build, and test low-cost, high-precision cargo delivery systems

Universal Technology Corporation — *Dayton, OH*

Research Engineer (On-site Contractor, Air Force Research Laboratory) — *Jan 2014 — Feb 2016*

- Developed a high performance cargo delivery optimization algorithm, enabling low-cost, real-time embedded application
- Identified innovative ways to plan cargo delivery, leading to improved accuracy and reliability at no additional cost

Research Engineer (On-site Contractor Air Force Research Laboratory) — *Summer 2013*

- Developed path planning/tracking algorithms and simulation tools to support the needs of the Unmanned Air Vehicle team in the Aerospace Systems Directorate as part of the Short Term Aerospace Research & Development Program

Intellimed Systems — *Cincinnati, OH*

Chief Technology Officer — *May 2010 — Jan 2014*

- Managed and led an interdisciplinary team of engineers and designers developing, building, and testing a novel medical imaging device
- Designed a human-machine interface for data change inspection aligned with a human's natural perception, reducing false positives

University of Cincinnati — *Cincinnati, OH*

Graduate Research Assistant — *2007-2014*

- Designed an analytic solution for constructing artificial vector fields in n-D space for waypoint navigation
- Developed a vector field following algorithm for nonlinear MIMO systems that leverages state-of-the-art massively parallel computing hardware
- Developed advanced control algorithms for approximating the inverse dynamics of MIMO nonlinear systems for use in trajectory tracking applications
- Developed novel scattered data interpolation/approximation algorithms that minimize memory usage and computational complexity while maximizing the numerical stability and accuracy of the resulting solutions
- Developed accelerated, near real-time, 3D vision position and orientation estimation algorithms/software that aid autonomous systems in perceiving their environments
- Assisted in the development of a surgical robotic/vision system that performs the milling/drilling operations required for the insertion of cochlear implants
- Developed accelerated GPU stereo processing software

Robotics Research Corporation — *Blue Ash, OH*

Computer Vision Consultant — *Summer 2010*

- Researched and evaluated commercial robotic vision systems for meeting specified requirements for an automated shipboard mixed load palletizing application for the US Navy
- Performed a top-level development of novel algorithms that enabled the adaptation of commercial robotic vision systems to an automated shipboard mixed load palletizing application in order to reduce hardware development time and cost

Computer Vision Consultant *Summer 2007*

- Designed, programmed, and tested a vision tracking and recognition system for aiding an autonomous ground vehicle in navigating urban combat zones for the US Army

Naval Research Laboratory — *Washington, DC*

Propulsion Engineer *2004-2007*

- Assisted in the design, development, analysis, build, test, and flight operations of an experimental upper stage propulsion system
- Designed a suite of spacecraft component and system data acquisition and control modules as part of a $600K facility test and development upgrade
- Developed mathematical models for determining fuel consumption and vehicle performance during flight operations required for maneuver planning and orbit determination

Praxis, Inc. — *Alexandria, VA*

Propulsion Engineer (On-site Naval Research Laboratory) *2004*

- Developed software tools for post-processing spacecraft flight performance data

Honors & Awards

Professional

2024	**Letter of Commendation**, Chief Scientist, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2023	**Best Presentation Award**, Aerospace Control and Guidance Systems Committee	***Missoula, MT***
2022	**Innovation Award**, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2020	**Technology Transfer & Transition Award**, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2017	**Innovation Award**, Air Force Research Laboratory	***WPAFB, OH***
2016	**General Benjamin D. Foulois Award**, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2016	**Innovation Award**, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2016	**Jr. Scientist and Engineer of the Quarter**, Aerospace Systems Directorate, Air Force Research Laboratory	***WPAFB, OH***
2006	**Certificate of Recognition**, DARPA	***Washington, DC***
2006	**Effort and Achievement Memorandum**, Space Propulsion Section, NRL	***Washington, DC***
2005	**Special-Act Award**, NRL	***Washington, DC***

Acedemic

2010	**Doctoral Fellowship**, NASA Ohio Space Grant Consortium	***Cleveland, OH***
2007	**Masters Fellowship**, NASA Ohio Space Grant Consortium	***Cleveland, OH***
2007	**Rensburg Fellowship**, Aerospace Department, University of Cincinnati	***Cincinnati, OH***
2007	**Bradley Jones Memorial Award**, Aerospace Department, University of Cincinnati	***Cincinnati, OH***

Education

University of Cincinnati — *Cincinnati, OH*

Doctor of Philosophy, Aerospace Engineering *Mar 2010 — Apr 2014*

Major: Controls and Dynamics | Minor: Intelligent Systems

Masters of Science, Aerospace Engineering *Sep 2007 — Mar 2010*

Major: Controls and Dynamics | Minor: Robotics

Bachelor of Science, Aerospace Engineering *Sep 2002 — Jun 2007*

Skills & Interests

Skills	Innovation, Algorithm Development, High-Performance Scientific Computing, Communicating
Software	Julia, Python, MATLAB, Simulink, C++, GPGPU, Git, DevOps, SolidWorks, Linux
Interests	Woodworking, Leathercrafting, Bushcrafting, Rucking, Reading, Spending time with family

Invited Lectures

National Center for Atmospheric Research — *Boulder, CO*

Uncertainty Propagation and Probabilistic Planning for Precision Airdrop Operations: A Series of Short Talks *2017*

University of Saint Francis, Sciences Department — *Fort Wayne, IN*

EctoScan™: Assessing and Tracking Inflammation Better, Faster, and Cheaper *2012*

Patents

Doman, D. B., **Gerlach, A.**, & Vandermey, J. T. (2019). *Apparatus and Method for Precision Ballistic Airdrop*.

Thomson, P. E., **Gerlach, A.**, & Smith, M. F. (2017). *Scanning System and Display for Aligning 3D Images with Each Other and/or for Detecting and Quantifying Similarities or Differences between Scanned Images*.

Gerlach, A., Thomson, P., & Walker, B. (2017). *Surface Data Acquisition, Storage, and Assessment System*.

Publications

Journal Articles

Utkarsh, U., Churavy, V., Ma, Y., Besard, T., Srisuma, P., Gymnich, T., **Gerlach, A.**, Edelman, A., Barbastathis, G., Braatz, R. D., & Rackauckas, C. (2024). Automated Translation and Accelerated Solving of Differential Equations on Multiple GPU Platforms. *Computer Methods in Applied Mechanics and Engineering*, *419*, 116591. https://doi.org/10.1016/j.cma.2023.116591

Meyers, J., Rogers, J., & **Gerlach, A.** (2021). Koopman Operator Method for Solution of Generalized Aggregate Data Inverse Problems. *J. Comput. Phys.*, *428*(110082), 110082. https://doi.org/10.1016/j.jcp.2020.110082

Leonard, A., Rogers, J., & **Gerlach, A.** (2020). Probabilistic Release Point Optimization for Airdrop with Variable Transition Altitude. *Journal of Guidance, Control, And Dynamics*, *43*(8), 1487–1497. https://doi.org/10.2514/1.G004959

Leonard, A., Rogers, J., & **Gerlach, A.** (2019). Koopman Operator Approach to Airdrop Mission Planning Under Uncertainty. *J. Guid. Control Dyn.*, *42*(11), 2382–2398. https://doi.org/10.2514/1.G004277

Leonard, A., Klein, B., Jumonville, C., Rogers, J., **Gerlach, A.**, & Doman, D. (2017). Probabilistic Algorithm for Ballistic Parachute Transition Altitude Optimization. *Journal of Guidance, Control, And Dynamics*, *40*(12), 3037–3049. https://doi.org/10.2514/1.G002243

Gerlach, A., & Doman, D. B. (2016). Analytical Solution for Optimal Drogue-to-Main Parachute Transition Altitude for Precision Ballistic Airdrops. *Journal of Guidance, Control, And Dynamics*, *40*(2), 439–452. https://doi.org/10.2514/1.G001824

VanderMey, J. T., Doman, D. B., & **Gerlach, A.** (2015). Release Point Determination and Dispersion Reduction for Ballistic Airdrops. *Journal of Guidance, Control, And Dynamics*, *38*(11), 2227–2235. https://doi.org/10.2514/1.G001157

Conference Papers

Gerlach, A. (2024). Simultaneous Planar Path Planning and Vector Field Generation via Interpolating Implicit Surfaces. *AIAA SciTech Forum*.

Utkarsh, U., Churavy, V., Ma, Y., Besard, T., Srisuma, P., Gymnich, T., **Gerlach, A.**, Edelman, A., Barbastathis, G., Braatz, R. D., & Rackauckas, C. (2023). Automated Translation and Accelerated Solving of Differential Equations on Multiple GPU Platforms. *Supercomputing 23*, *419*, 116591. https://doi.org/10.1016/j.cma.2023.116591

Schierman, J. D., **Gerlach, A.**, & Doman, D. B. (2023). Explicit Uncertainty Quantification for Systems with Parametric Uncertainty. *AIAA SCITECH2023 Forum*. https://doi.org/10.2514/6.2023-1096

Bak, S., Bogomolov, S., Duggirala, P. S., **Gerlach, A.**, & Potomkin, K. (2021). Reachability of Black-Box Nonlinear Systems after Koopman Operator Linearization. *7th IFAC Conference on Analysis and Design of Hybrid Systems*, 253–258.

Berneburg, J. A., Garcia, E., **Gerlach, A.**, Casbeer, D., & Nowzari, C. (2020). Strongly Non-Zeno Event-Triggered Wireless Clock Synchronization. *21st IFAC World Congress*, *53*, 2745–2750. https://doi.org/10.1016/j.ifacol.2020.12.928

Wilhelm, J., Clem, G., Casbeer, D., & **Gerlach, A.** (2019). Circumnavigation and Obstacle Avoidance Guidance for UAVs Using Gradient Vector Fields. *AIAA Scitech2019 Forum*.

Meyers, J. J., Leonard, A. M., Rogers, J. D., & **Gerlach, A.** (2019). Koopman Operator Approach to Optimal Control Selection Under Uncertainty. *2019 American Control Conference (ACC)*, 2964–2971. https://doi.org/10.23919/ACC.2019.8814461

Rogers, J. D., Leonard, A., Jumonville, C., **Gerlach, A.**, & Doman, D. (2017). Shaping Dispersion Patterns in Complex Dropzones Through Parachute Transition Altitude Optimization. *24th AIAA Aerodynamic Decelerator Systems Technology Conference*. https://doi.org/10.2514/6.2017-3392

Leonard, A., Rogers, J. D., **Gerlach, A.**, & Doman, D. (2017). A Probabilistic Approach to the Optimal Determination of a Computed Air Release Point. *24th AIAA Aerodynamic Decelerator Systems Technology Conference*. https://doi.org/10.2514/6.2017-3223

Gerlach, A., Doman, D., Rogers, J. D., & Leonard, A. (2017). Probabilistic Airdrop Planning for Dynamic Drop Zones. *24th AIAA Aerodynamic Decelerator Systems Technology Conference*. https://doi.org/10.2514/6.2017-3224

Gerlach, A., Doman, D., Henry, M., & Patel, S. (2017). Characterizing the Performance of Transition Altitude Optimization for High Altitude-Low Opening Ballistic Airdrop. *24th AIAA Aerodynamic Decelerator Systems Technology Conference*. https://doi.org/10.2514/6.2017-3221

Vandermey, J. T., Doman, D. B., & **Gerlach, A.** (2016). Release Point Determination and Dispersion Reduction for Ballistic Airdrops. *AIAA SciTech Forum*. https://doi.org/10.2514/6.2016-1537

Gerlach, A., & Doman, D. B. (2016). Wind Field Estimation From Airdrop Trajectory Measurements. *AIAA Guidance, Navigation, And Control Conference*. https://doi.org/10.2514/6.2016-1616

Gerlach, A., Manyam, S. G., & Doman, D. B. (2016). Precision Airdrop Transition Altitude Optimization via the One-in-a-Set Traveling Salesman Problem. *2016 American Control Conference (ACC)*, 3498–3502. https://doi.org/10.1109/ACC.2016.7525455

Gerlach, A., & Doman, D. B. (2016). Analytical Solution for Optimal Drogue-to-Main Parachute Transition Altitude for Ballistic Airdrops. *AIAA Guidance, Navigation, And Control Conference*. https://doi.org/10.2514/6.2016-0868

Gerlach, A., Kingston, D., & Walker, B. K. (2014). UAV Navigation Using Predictive Vector Field Control. *2014 American Control Conference*, 4907–4912. https://doi.org/10.1109/ACC.2014.6859082

Gerlach, A., & Walker, B. K. (2013). Trajectory Tracking by Approximate Inverse Dynamics: IDRBF Computational Considerations. *AIAA Infotech@Aerospace (I@A) Conference*. https://doi.org/10.2514/6.2013-4573

Gerlach, A., & Walker, B. K. (2013). Directly Controlling the Sparsity of an Interpolation Matrix Formed by Compactly Supported RBFNs. *AIAA Infotech@Aerospace (I@A) Conference*. https://doi.org/10.2514/6.2013-5061

Gerlach, A., & Walker, B. K. (2013). Trajectory Tracking by Approximate Inverse Dynamics: An Introduction to the IDRBF Algorithm. *Guidance, Navigation, And Control and Co-located Conferences*. https://doi.org/10.2514/6.2013-4572

Gerlach, A., & Walker, B. (2012). Accelerating Robust 3D Pose Estimation Using C*-Images. *50th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition*. https://doi.org/10.2514/6.2012-602

Gerlach, A., & Walker, B. K. (2011). Accelerating Robust 3D Pose Estimation Utilizing a Graphics Processing Unit. *Proc. SPIE 7878, Intelligent Robots and Computer Vision XXVIII: Algorithms and Techniques*, *7878*, 78780. https://doi.org/10.1117/12.876713

Netwall, C., Osborn, M., Clauss, C., & **Gerlach, A.** (2007). Transient Pressure Analysis and Verification Testing for the Micro-satellite Technology Experiment Upper Stage Propulsion System. *43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit*. https://doi.org/10.2514/6.2007-5523

Theses

Gerlach, A. (2014). *Autonomous Path-Following by Approximate Inverse Dynamics and Vector Field Prediction*.

Gerlach, A. (2010). *Performance Enhancements of the Spin-Image Pose Estimation Algorithm*.

Advised Theses

Meyers, J. (2022). *Koopman Operator Approach to Uncertainty Quantification and Decision-Making*.

Leonard, A. (2019). *Probabilistic Methods for Decision Making in Precision Airdrop*.