

RESUME

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EDUCATION

- 1989 - 1990 PhD., Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, Virginia
- 1986 - 1989 Master's Degree, Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, Virginia
- 1981 - 1985 B. S. in Physics, University of Southern Mississippi, Hattiesburg, Mississippi

APPOINTMENTS

- 1990-1996 Assistant Professor, Aerospace Engineering, Auburn University
- 1996-2007 Associate Professor, Aerospace Engineering, Auburn University
- 2007-2010 Professor, Aerospace Engineering, Auburn University
- 2010-present Walt and Virginia Woltosz Professor, Aerospace Engineering, Auburn University

PROFESSIONAL ORGANIZATIONS

- American Society of Mechanical Engineers (ASME)
- American Institute of Aeronautics and Astronautics (AIAA)
- Society of Automotive Engineers (SAE)
- Member of the AIAA High Speed Airbreathing Propulsion Technical Committee
- Member of the ASME Propulsion Technical Committee
- Member: Applied Aerodynamics (APA) Technical Committee, AIAA, 2004-2008.

HONORS

- Associate Fellow, AIAA

REFEREED JOURNAL ARTICLES

1. Jenkins, Rhonald, and Hartfield, Roy, "Hybrid Particle Swarm-Pattern Search Optimizer for Aerospace Propulsion Applications," accepted for publication in Journal of Spacecraft and Rockets, 2011.
2. Riddle, D., Hartfield, R., Burkhalter, J. E., and Jenkins, R. M., "Design of Liquid Rocket Powered Missile Systems Using a Genetic Algorithm," Journal of Spacecraft and Rockets, Vol. 46, No 1, January-February 2009, pp. 151-159.
3. Bayley, D. J., Hartfield, R. J., Burkhalter, J. E., and Jenkins, R. M., "Design Optimization of Space Launch Vehicle Using a Genetic Algorithm," Journal of Spacecraft and Rockets, Vol. 45, No. 4, July-August 2008, pp. 733-740.
4. Hartfield, Roy J., Jenkins, Rhonald M., Burkhalter, John E., "Ramjet Powered Missile Design Using a Genetic Algorithm," Journal of Computing And Information Science In Engineering, Vol. 7, No. 2, June, 2007.
5. Hartfield, Roy J., Jenkins, Rhonald M., Burkhalter, John E., "Optimizing a Solid Rocket Motor Boosted Ramjet Powered Missile Using a Genetic Algorithm", Applied Mathematics and Computation, Vol. 181, no2, (2006) pp. 1720-1736
6. Hartfield, R.J., Burkhalter, J. E., and Jenkins, R. M., "Scramjet Missile Design Using Genetic Algorithms", Applied Mathematics and Computation, Vol. 174, No2, (2006), pp. 1539-1563.
7. Hartfield, Roy J. Jr., "Interpretation of Spectroscopic Data From the Iodine Molecule Using a Genetic Algorithm," Applied Mathematics and Computation, Vol. 177, (2006), pp 597-605.
8. Hartfield, Roy J., Jenkins, Rhonald M., Burkhalter, John E., and Foster Winfred, "Analytical Methods for Predicting Grain Regression in Tactical Solid-Rocket Motors," Journal of Spacecraft and Rockets, Vol.41 No. 4, July-August 2004, pp.689-693.
9. Hartfield, R., Burkhalter, J., Jenkins, R., and Witt, J., "Analytical Development of a Slotted Grain Solid Rocket Motor," Journal of Propulsion and Power, Vol. 20, No. 4, July-August 2004, pp. 690-694.
10. Szasz, G., Flowers, G., and Hartfield, R., "Hub Based Vibration Control of Multiple Rotating Airfoils," Journal of Propulsion and Power, Vol.16, No. 6, November 2000, pp. 1155-1163.
11. Hartfield, R. J., Rose, Steven K., and Abbitt, J. D., "Computational Fluid Imaging for Iodine Fluorescence in Compressible Flows," Applied Mathematics and Computation, Vol. 95, (1998) pp 63-73.
12. Hartfield, R. J., and Bayley, D. J., "Experimental Investigation of Angled Injection in a Compressible Flow," Journal of Propulsion and Power, Vol. 12, No. 2, March 1996, pp. 442-445.
13. Eklund, D. R., Fletcher, D. G., Hartfield, R. J., Jr., Northam, G. B., and Dancey, C. L., "A Comparative Computational/Experimental Compressible Flow Field Investigation. Mach 2 Flow Over a Rearward-Facing Step," Computers in Fluids, Vol. 24, No. 5, pp. 593-608.

14. Burkhalter, J. E., Hartfield, R. J., and Leleux, T. M., "Non-Linear Aerodynamic Analysis of Grid Fin Configurations," Journal of Aircraft, Vol. 32, No. 3, May 1995, pp. 547-554.
15. Eklund, D. R., Fletcher, D. G., Hartfield, R. J., Jr., McDaniel, J. C., Northam, G. B., Dancey, C. L., and Wang, J. A., "A Comparative Computational/Experimental Compressible Flow Field Investigation. Staged Normal Injection into a Mach 2 Flow Behind a Rearward-Facing Step," AIAA Journal, Vol. 32, No. 5, May 1994, pp. 907-916.
16. Hollo, S. D., McDaniel, J. C. and Hartfield, R. J., Jr., "Quantitative Investigation of Compressible Mixing: Staged Transverse Injection into Mach 2 Flow," AIAA Journal, Vol. 32, No. 3, March 1994, pp. 528-534.
17. Hollo, S. D., Hartfield, R. J., Jr. and McDaniel, J. C., "Planar Velocity Measurement in Symmetric Flow Fields Using Laser-Induced Iodine Fluorescence," Optics Letters, Vol. 19, No. 3, February 1994, pp. 216-218.
18. Hartfield, R. J., Hollo, S. D. and McDaniel, J. C., "Experimental Investigation of a Supersonic Swept Ramp Injector Using Laser-Induced Iodine Fluorescence," Journal of Propulsion and Power, Vol. 10, No 1, February 1994, pp. 129-135.
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20. Abbitt, J. D., Hartfield, R. J. and McDaniel, J. C., "Mole Fraction Imaging of Transverse Injection in a Ducted Supersonic Flow", AIAA Journal, Vol. 29, No 3, March 1991, pp. 431-435.
21. Hartfield, R. J., Hollo, S. D., and McDaniel, J. C., "Planar Temperature Measurement in Compressible flows Using Laser-Induced Iodine Fluorescence," Optics Letters, January 15, 1991 pp. 106-108.
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White, P. S., Best, S. R., Hrbud, I., Hartfield, R. J., and Rose, M. F., "RF Plasma Thrusters for SMALLSAT Applications," AIAA-99-2438, Presented at the 35th AIAA/SAE/ASME/ASEE Joint Propulsion Conference and Exhibit, Los Angeles, CA, June 1999.

Wehrmeyer, J., Hartfield, R., Trinh, H., Dobson, C., and Eskridge, R., "Raman Gas Species Measurements in Hydrocarbon-Fueled Rocket Engine Injector Flows," AIAA 2000-3391, Presented at the 36th AIAA/SAE/ASME/ASEE Joint Propulsion Conference and Exhibit, Huntsville, AL, July 2000.

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Burger, Christoph and Hartfield, Roy J., "Wind Turbine Airfoil Performance Optimization using the Vortex Lattice Method and a Genetic Algorithm", AIAA 2006-4051, Presented at the 4^h AIAA Energy Conversion Engineering Conference, San Diego, CA, June 26-29, 2006.

Hartfield, R. J., "Incorporating Optimization in the Study of Rocket Propulsion AIAA 2006-4314, Presented at the 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Sacramento, CA, July 9-12, 2006.

Metts, J., Hartfield, R., Burkhalter, J. and Jenkins, R., "Reverse Engineering of Solid Rocket Missiles with a Genetic Algorithm", AIAA Paper 2007-0363, Presented at the 45th Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan 8-11, 2007.

Riddle, D., Hartfield, R., Burkhalter, J. E., and Jenkins, R. M., "Design of Liquid Rocket Powered Missile Systems Using a Genetic Algorithm", AIAA Paper 2007-0362, Presented at the 45th Aerospace Sciences Meeting and Exhibit, Reno, NV, Jan 8-11, 2007.

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Burger, Christoph and Hartfield, Roy J., "Design, Testing and Optimization of a Constant Torque Propeller," AIAA paper 2007-3927, Presented at the 25th AIAA Applied Aerodynamics Conference, Miami, Florida, June 25-28, 2007.

Bayley, Douglas and Hartfield, Roy, J., "Design Optimization of Space Launch Vehicles for Minimum Cost Using Different Propulsion Types and a Genetic Algorithm," AIAA paper 2007-5852, Presented at the 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, Cincinnati, OH, July 8-11, 2007.

Doyle, J., Hartfield, R.J., and Roy, C. "Aerodynamic Optimization for Freight Trucks using a Genetic Algorithm and CFD", AIAA 2008-0323, Presented at the 46th Aerospace Sciences Meeting and Exhibit, Reno, NV, January 2008.

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McDavid, Brian; Hartfield, Roy, and Burkhalter, John, "Launch Vehicle Performance Enhancement Using Aerodynamic Lifting During Early Flight", AIAA 2008-6916, Presented at the 26th AIAA Applied Aerodynamics Conference, August 18-21, 2008, Honolulu, HI.

Dyer, John; Hartfield, Roy; Dozier, Gerry, and Burkhalter, John, "Optimization of Various Aerospace Engineering Applications Using a Real-Coded Genetic Algorithm", AIAA 2008-5921, Presented at the 12th AIAA Multidisciplinary Analysis and Optimization Conference, September 10-12, 2008, Victoria, BC.

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Hartfield, Roy J., Burkhalter, John E., Jenkins, Rhonald M., Metts, Jonathan, Riddle, David E., and Dyer, John, “Genetic Algorithm Developments for Liquid Missile Analysis”, submitted to Missile and Space Intelligence Center Redstone Arsenal, Alabama 35898, September 2006, Reference Contract No. PAN 50353-05.

Hartfield, Roy J., Burkhalter, John E., Jenkins, Dyer, John, and McDavid, Brian, “Hypersonic Outer Tier – Development Interceptor Concepts/Trades Solid Rocket Motor Boosted Ramjet and Other Test Cases Optimized using a Genetic Algorithm” US Army Aviation and Missile Research Development and Engineering Center, Redstone Arsenal, AL 35898, March 2007, Under Contract: ARMYW31P4Q05CR1383AA.

Hartfield, Roy J., Burkhalter, John E., Jenkins, Rhonald M., Riddle, David E., and Dyer, John, “Genetic Algorithm Developments for Multiple Stage, Non-Constant Diameter Missiles”, submitted to Missile and Space Intelligence Center Redstone Arsenal, Alabama 35898, February, 2008, Reference Contract No. PAN 70084-07.

Crocker, Malcolm J., and Hartfield, Roy J., “Water Injection for Reduction of Launch Noise and Suppression of Ignition Overpressure Generated by Launch Vehicles,” Final Report submitted to United Launch Alliance, December 2008.

Hartfield, Roy, Burkhalter, John, Jenkins, Rhonald, Badyrka, Jeffrey, Hurston, Benjamin, Johnson, Casey and Druckemiller, Justin, “Genetic Algorithm Guidance & Control Goal Definitions Upgrade” submitted to Missile and Space Intelligence Center Redstone Arsenal, Alabama 35898, March, 2009.

Hartfield, Roy J., and Crocker, Malcolm, J., "Assessment of Launch Vehicle Ascent Pressure Fluctuation Levels," Final Report for NASA

Hartfield, Roy J., and Ahmed, Anwar, "Dynamic (power-on) Propeller Efficiency and Acoustic Study," Submitted to US Army, AMRDEC, Redstone Arsenal, AL, January 2010.

Hartfield, Roy J., Burkhalter, John E., Jenkins, Rhonald M., Albarado, K., Badyrka, J., and Hurston, B., "Genetic Algorithm Development for Multi-Optimal Solution Characterization & Trajectory Matching", Roy Hartfield, submitted to Missile and Space Intelligence Center Redstone Arsenal, Alabama 35898, March 2010.

Hartfield, R. J., Cochran, J.E., and Crouse, G., "Evaluation of Future Rotary Wing Vehicle Concepts Using Optimization Based Trade Studies", Submitted to US Army, AMRDEC, Redstone Arsenal, AL, June 2010.

RESEARCH EXPERIENCE

My primary research interest in graduate school was non-intrusive flow diagnostics primarily for high speed compressible flows. I continued to work in that area for several years and developed some innovative techniques using Raman Scattering at NASA MSFC. For reasons of professional interest, I began to pursue avenues of research involving design. Gradually, I moved from experimental flow diagnostics to more conventional wind tunnel testing, modeling of aerodynamic and propulsion systems and finally to optimizing such systems. This change in focus for my research has been very successful and I have now established a strong research program in the area of design optimization for aerospace systems using Genetic Algorithms and other optimizers. This work includes modeling and optimizing complete missile systems, aerodynamic shapes, UAV components, propellers, wind turbines and other devices. Currently, I am directing seven graduate students, all of whom work in the area of analysis, design or design optimization.

In the area of rocket design, I have a continuing program funded periodically by MSIC and the US Army to develop the tools necessary for design and reverse engineering of missiles. I have completed two efforts with Dr. Malcolm Crocker to predict the pressure fluctuation levels on new launch vehicles. One of these efforts was funded by NASA and the other was funded by the United Launch Alliance.

Ongoing efforts also include missile system analysis work funded by MSIC, risk assessment for unmanned aerial vehicles funded by the FAA, scramjet powered vehicle optimization, transport aircraft outer mold line optimization, surrogate modeling for turbofan engines and missile aerodynamics, and the use of aero-assist for launch vehicle configurations. I am also currently writing a text entitled "Applied Rocket Propulsion" under contract with John Wiley.

SELECTED RESEARCH CONTRACTS

"Development of Nonintrusive, Scatter-Independent Techniques for Measurement of Liquid Density Inside Dense Sprays," Hartfield, R., funded by NASA MSFC, December 1993 to December 1994, \$20,000.

"Hydrocarbon-Fueled Rocket Plume Measurement Theoretical Development," Hartfield, R., funded by NASA MSFC through Vanderbilt University from May 1, 1998 - December 31, 2000, \$15,000.

“Nonlinear Dynamics and Control Issues for Bladed Disk Vibration Suppression Using Magnetic Bearings,” National Science Foundation, \$176,414 plus COE cost sharing, 3 years (1996-2000), George Flowers, P.I., Subhash Sinha, Co-P.I. and Roy Hartfield, Co-P.I.

Internal Grant sponsored by the Vice President to support outside lecture by Dr. J. Parker Lamb, \$500, May 1998, R. Hartfield.

“Suppression of Flow Induced Vibrations Using Active Control of Blade Tip Clearance,” Ahmed, A., Flowers, G. and Hartfield, R., Auburn University Infrastructure Award for fiscal 2000 and fiscal 2001, \$99,320.

“Suppression of Flow Induced Vibrations Using Active Control of Blade Tip Clearance,” Flowers, G., Hartfield, R., and Ahmed, A., Auburn University Graduate Student Research Assistantship program for fiscal 2000 and fiscal 2001, \$20,000.

“Genetic Algorithms for Missile Analysis,” Missile and Space Intelligence Center, Redstone Arsenal, AL, \$99,951, May 16, 2002 – Feb 15, 2003, J.E. Burkhalter, R.M. Jenkins, and R.J. Hartfield.

“Missile Design Synthesis, Genetic Algorithm Method,” U. S. Army Aviation and Missile Command, Redstone Arsenal, AL \$74,750, May 16, 2002 – Dec 31, 2002, J.E. Burkhalter, R.M. Jenkins, R.J. Hartfield.

“MC-130H Model Construction and Wind Tunnel Tests”, Burkhalter, John E. and Hartfield, Roy J., funded by Support Systems Associates, Inc., Melbourne, FL, \$57,717, May 2003-September 2003.

“Model Development and Wind Tunnel Test for the MC-130E Aircraft- Phase I”, Hartfield, Roy J. and Burkhalter, John E., funded by Support Systems Associates, Inc., Melbourne, FL, \$49,581, March 2004-May 2004.

“Model Development and Wind Tunnel Test for the MC-130E Aircraft- Phase II”, Hartfield, Roy J. and Burkhalter, John E., funded by Support Systems Associates, Inc., Melbourne, FL, \$69,777, May 2004-December 2004.

“Genetic Algorithm Upgrade”, Hartfield, R. J., Burkhalter, J. E. and Jenkins, R. M., funded by Missile and Space Intelligence Center, Redstone Arsenal, AL, \$49,950, June 16, 2004-June 15, 2005.

“Aerodynamic Drag Reduction and Safety Analysis for Tractor/Trailers”, Roy, C. J., Ahmed, A. and Hartfield, R. J., Department of Transportation, federal Motor carrier Safety Administration, in conjunction with Digital Fusion of Huntsville, AL, September 2005- September 2006, \$248,000, 1 year.

“Genetic Algorithm Developments for Liquid Missile Analysis”, Roy Hartfield, PI, MSIC, September 16, 2005 to September 15, 2006, \$149,950.

“Genetic Algorithm Support,” Roy Hartfield, PI, MSIC, May 15, 2006 to August 7, 2006, \$24,584.

“HOT-D RAMJET Development,” Roy Hartfield, PI, System Simulation and Development Directorate US Army AMRDEC, April 19, 2006 to December 31, 2006, \$100,000.

“Genetic Algorithm Developments for Multiple Stage, Non-Constant Diameter Missiles,” Roy Hartfield, PI, MSIC, January 22, 2007 to January 21 2008, \$100,000.

“Launch Vehicle Ascent Aeroacoustics,” Roy Hartfield, PI, Malcolm Crocker PI, NASA Marshall Space Flight Center, November 2007 to October 2010, \$249,000.

“Genetic Algorithm Guidance & Control Goal Definitions Upgrade,” Roy Hartfield, PI, MSIC, March, 2008 to March 2009, \$150,000.

“Water Injection for Reduction of Launch Noise”, Malcolm Crocker, PI and Roy Hartfield, PI, United Launch Alliance, October 1, 2008-December 15, 2008, \$60,000.

“Genetic Algorithm Development for Multi-Optimal Solution Characterization & Trajectory Matching”, Roy Hartfield, PI, MSIC, March, 2009 to March 2010, \$150,000.

“Dynamic (power-on) Propeller Efficiency and Acoustic Study,” Roy Hartfield, PI, and Anwar Ahmed, Co-PI, AMRDEC, Redstone Arsenal, September 29, 2009 to December 15, 2009, \$25,000.

“Evaluation of Future Rotary Wing Vehicle Concepts Using Optimization Based Trade Studies”, Roy Hartfield, PI, John Cochran, Co-PI, and Gilbert Crouse, Co-PI, AMRDEC, Redstone Arsenal, September 29, 2009 to December 15, 2009, \$149,000.

Optimization Techniques For Advanced Missile Analysis, Roy Hartfield, PI, Missile and Space Intelligence Center, Redstone Arsenal, March 2010 to March 2011, \$175,000.

“Development of Probability Models for UAS Performance,” Wesley Randall, Roy Hartfield, David (Mark) Carpenter, FAA, August 16, 2010 – August 15, 2011, FAA, \$300,000.

UNIVERSITY SERVICE (Selected Items Only)

Member, University Tenure and Promotion Committee, 2007- 2010

Member, University Faculty Welfare Committee, 2007 – 2010

Chair, University Faculty Welfare Committee, 2008

Member, University Campus Planning Committee, 1994-1996

AE representative on the College of Engineering Initiatives Committee 1993-1997

AE Graduate Program Officer, 1997-2004

AE Departmental E-Day coordinator, 1992-2002

CONSULTING AND PROFESSIONAL ACTIVITIES

Member: Applied Aerodynamics (APA) Technical Committee, AIAA, 2004-2008

Secretary: Applied Aerodynamics (APA) Technical Committee, AIAA, 2005-2006

Chair of the Aerodynamic Design Subcommittee: APA TC, AIAA, 2005-2007

Technical Chair of the Applied Aerodynamics Conference, San Francisco, CA, June 2006

Member: AIAA High Speed Airbreathing Propulsion Technical Committee, 2008-present.

“Propulsion Short Course,” presented to the Missile Space Intelligence Center, June 11-12, 2001 in collaboration with Dr. Rhonald Jenkins.

“Solid Rocket Motor Component Design,” a short course presented to the Missile Space Intelligence Center, May, 2002 in collaboration with Dr. Rhonald Jenkins.

“Advanced Topics in Solid Rocket Motor Design,” A short course presented to the Missile Space Intelligence Center, July, 2003 in collaboration with Dr. Rhonald Jenkins.

“Liquid Rocket Propulsion,” A short course presented to analyst at the Central Intelligence Agency, August 6-10, 2007 in collaboration with Dr. Rhonald Jenkins.

A short course for the University of Kansas in conjunction with Dr. Rhon Jenkins entitled: “Solid Rocket Motor Propulsion”, October 30-November 1, 2007, Orlando, FL.

A short course presented at NASA MSFC in conjunction with Dr. Rhon Jenkins and Dr. Winfred Foster entitled: “Solid Rocket Motor Propulsion”, July 20-24, 2009, and again on Feb. 8-12, 2010, Huntsville, AL.

A short course presented at NASA MSFC in conjunction with Dr. Rhon Jenkins and Dr. Winfred Foster entitled: “Combustion Devices”, July 19-23, 2010, Huntsville, AL.

Hartfield Technology Company, Development of a Rotary Vane Engine.

NASA MSFC Summer Faculty Program, 1992, 1993, 1995, 1996

Reviewer for McGraw Hill dynamics texts

Reviewer for AIAA Journal

Reviewer for Journal of Propulsion and Power

Reviewer for Journal of Heat Transfer

Reviewer for Experiments in Fluids

Applicant Reviewer for the National Defense Science and Engineering (NDSE) Graduate Fellowship Program, 1994, 1996, 1998.

TECHNOLOGY DEVELOPMENT

During the spring of 2008, Kondor Model Products of Thunder Bay, Ontario licensed a propeller drive technology developed by Christoph Burger and Roy Hartfield. This company is developing this technology for use in light sport aircraft and UAV's. The licensing agreement has been transferred to Aerovate and a patent for the device has been applied for. A photo of the Aerovate device is shown below.



COURSES TAUGHT

Quarter System

EGR 205 Undergraduate Statics
EGR 210 Mechanics for Electrical Engineers
AE 226 Undergraduate Aerospace Dynamics
AE 302 Undergraduate aerodynamics
AE 310 Undergraduate Aerospace Analysis
AE 326 Undergraduate Aerospace Dynamics
AE 415 Undergraduate Jet Propulsion
AE 517 Undergraduate/Graduate Solid Rocket Propulsion
AE 612 Graduate Aerothermochemistry (With Video Outreach Option)

Semester System

AERO 7970/7976/4970, Special Topics: Statistical Modeling and Analysis in Engineering, with Dr. Mark Carpenter of MAT
AERO 7510/7516 Thrust Generation (With Video Outreach Option)
AERO 7530/7536 Aerothermochemistry (With Video Outreach Option)
AERO 5110/6110/6116 Missile Aerodynamics (With Video Outreach Option)
AERO 5520/6520/6526 Rocket Propulsion (With Video Outreach Option)
AERO 5530/6530/6536 Space Propulsion (With Video Outreach Option)
AERO 4510 Jet Propulsion
AERO 4140 Aerodynamics III
ENGR 2350 Engineering Dynamics
AERO 3110 Aerodynamics I